

Thesis/
Reports
Andrews, T.

INTRODUCTION TO THE RESEARCH NATURAL
AREA MATRIX FOR THE ROCKY
MOUNTAIN REGION

by
Tom Andrews

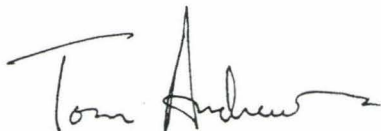
MEMORANDUM

TO: Mike Ryan
FROM: Tom Andrews
DATE: September 30, 1993
SUBJECT: RNA Matrix and associated documents

Enclosed is the final report which completes the final Stage, Stage 2, of Cooperative Agreement No. 28-C2-633 between The Nature Conservancy and the Rocky Mountain Forest and Range Experiment Station.

The final report consists of the following separate documents:

Introduction to the RNA Matrix
Subdivision Map for the RNA Matrix
The RNA Matrix for the Rocky Mountain Region
Plant Association Appendix to the RNA Matrix
Criteria for RNA Selection
The Role of RNAs in Ecosystem Management
RNA Management Area Prescription
SIA Management Area Prescription



Tom Andrews
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INTRODUCTION TO THE RESEARCH NATURAL AREA MATRIX
FOR THE ROCKY MOUNTAIN REGION

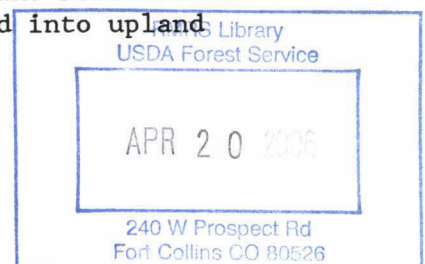
A principal purpose of the Research Natural Area (RNA) system is to provide a representative range of relatively undisturbed sites for research, monitoring, biodiversity protection, and as reference areas for management activities throughout National Forest System (NFS) lands. In order to accomplish this, the RNA System should encompass a large part of the natural variability (ecological diversity) on NFS lands.

The RNA Matrix is being developed as a tool for identifying the ecological elements targeted for inclusion in the RNA system. The current draft is intended for review and interim direction for National Forests and Grasslands.

Because plant communities are estimators of other ecological variables (such as soils, climate, landforms, and some animals), they have been used to define the elements of natural variability to be represented by the RNA system. Ideally, the RNA system would eventually represent all or most of the ecological diversity found in the over 400 plant associations and community types known for the Rocky Mountain Region. However, in order to provide a more manageable array of targets, the Series level of plant community classification has been provisionally chosen to define the target elements for the RNA system. Plant associations are grouped into Series based on the climax dominant overstory species. Some of the plant Series for non-forest types have been aggregated into Series groups based on Johnston (1987) and Bourgeron (1993) (see matrix footnotes for references). The Series level will be compatible with the regional and national Hierarchical Framework of Ecological Units as well as SAF Cover Types, Kuchler's classification, and the classification being prepared by the Western Regional Office of The Nature Conservancy. However, it is possible that some of the Series groupings will change. It is very unlikely that any changes will affect the validity of RNAs selected on the basis of Series targets. As the regional Integrated Resource Inventory is developed and more specialized studies undertaken, it will be possible to determine how well ecological variation other than plant communities (soils, climate, and landforms) is represented by the RNA system.

The RNA Matrix consists of two documents. The first document provides the Series elements targeted for inclusion in the RNA system. The second and longer document is an Appendix which identifies the plant associations and community types which are known to occur on NFS lands. Although our knowledge of these plant associations and community types and their distribution is incomplete, the Appendix is provided as a partial means of evaluating how well RNAs represent this plant community diversity.

The RNA Matrix is divided into a section on National Forests and one on plains grasslands (National Grasslands and parts of Black Hills and Nebraska National Forests). Each of these sections has been further divided into upland communities and wetland and riparian communities.



For targeting purposes the Rocky Mountain Region has been divided into three National Forest subdivisions and one National Grassland subdivision as shown on the accompanying map. Each Series group is targeted for each of the subdivisions in which it occurs. This helps assure that the RNA system will represent the broad range of natural variability that occurs from the northern to the southern ends of the Region. To illustrate, a particular targeted element (e.g. Subalpine Fir Series) which occurs in northern Wyoming is likely to differ from the same element occurrence in southern Colorado. By having RNAs for this element in each regional subdivision, the range of diversity which occurs within this ecological element will be better represented. Further duplication of this representation may be desirable to help assure against the possibility of RNA or biodiversity loss due to natural catastrophe or site degradation. The subdivisions have been chosen to correspond to the draft regional Section Map of Ecological Land Units as follows:

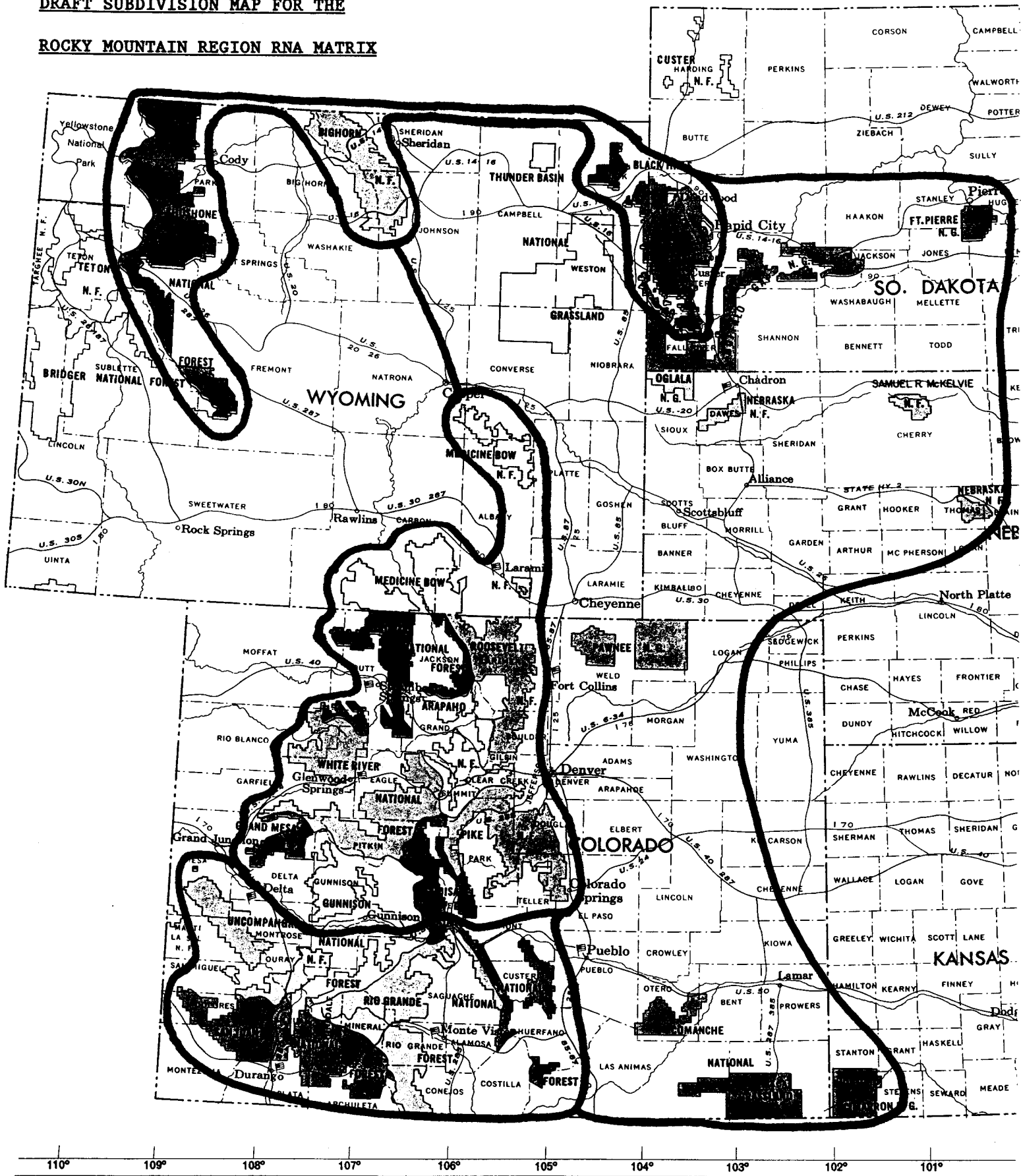
<u>Subdivisions</u>	<u>Sections</u>
Nebraska, S.Dakota, and northern Wyoming	M3315 Thrust Belt Ranges M3316 Black Hills Section M3317 Bighorn Mountains M3318 Yellowstone Highlands
Southern Wyoming and northern Colorado	M3311 Northern Parks and Ranges M3312 North Central Highlands
Southern Colorado	M3313 South Central Highlands M3314 Southern Parks and Ranges
Plains Grasslands	315, 331, and 332 Provinces

As the RNA Matrix Appendix shows, some of the targeted Series, such as ponderosa pine, Douglas-fir, subalpine fir, and aspen, contain a large number of plant associations and community types. These widely occurring and important Series possess a wide range of natural variability. It will probably be necessary to establish more than one RNA per regional subdivision to adequately represent the plant associations and community types within these diverse Series.

The shaded cells in the RNA Matrix indicate National Forests and Grasslands which could potentially satisfy the goal of representing Series/Subdivision targets in the RNA system. Future information should expand this list of possibilities. There are approximately 100 Series/Subdivision targets indicated in the matrix. An individual RNA may well represent more than one of these targets. As the RNA system for the Rocky Mountain Region expands and the knowledge of vegetation distribution increases, individual plant association and community type gaps will become more obvious and targetable.

The RNA Matrix for the Rocky Mountain Region is a tool for the preliminary evaluation of candidate RNA sites and for developing a representative RNA system. It is an incomplete tool in need of refinement. There is a lot we still do not know about the distribution of plant associations and community types within the Region. The targets shown in the matrix should be considered as flexible goals. The RNA matrix will evolve over time, and the extensive ecological knowledge of District, Forest, Region, and Station personnel and the interested public will be both appreciated and necessary for this evolution. For more information about the methodology used to develop the RNA Matrix, please contact the RNA coordinator or RNA ecologist.

ROCKY MOUNTAIN REGION RNA MATRIX



DRAFT – RESEARCH NATURAL AREA MATRIX FOR THE ROCKY MOUNTAIN REGION

NATIONAL FORESTS

SERIES	NEBRASKA, S.DAKOTA AND N. WYOMING				SOUTHERN WYOMING AND NORTHERN COLORADO***							SOUTHERN COLORADO			
UPLAND SERIES	Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGM	NSI	SSI	Unc	Rio	SJu

FOREST SERIES

Ponderosa Pine	**	UP1*									****				NAR
Douglas-fir			SHL					SAD?							
Blue Spruce					XXX	XXX	XXX	XXX	XXX				ESC		
White Fir															WLL
White Spruce															
Lodgepole Pine			BUL?		SND?										
Whitebark Pine															
Limber Pine															
Bristlecone Pine							MTG								
Englemann Spruce															
Subalpine Fir					SND?						GOT?				
Rocky Mountain Aspen		XXX							SAB?					XXX	

WOODLAND SERIES

Juniper and Pinyon															NAR?
Rocky Mountain Juniper			SHL												

SHRUBLAND SERIES

Mountain Mahogany and Skunkbrush															
Gambel Oak															NAR
Serviceberry, Chokecherry, Snowberry, and Shrubby Cinquefoil															
Rock, Scree, and Cliff Vegetation															
Big Sagebrush															
Low, Alkali, and Threetip Sagebrush															
Bitterbrush															
Black and Silver Sagebrush			SHL												

MOUNTAIN AND FOOTHILLS GRASSLAND SERIES

Rough and Idaho Fescue			BLI												
Thurber Fescue and Porter Ligusticum															
Parry Oatgrass, Arizona Fescue, Muhly, and Blue Grama								SAD?							
Bluegrass Wheatgrass and Needle-and-thread															
Timber Oatgrass															

ALPINE SERIES

Alpine Grassland and Ridge			XXX		XXX					GOT					
Alpine Fellfield			XXX		XXX						XXX		XXX	XXX	

WETLAND AND RIPARIAN SERIES	Neb	BlH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGM	NSI	SSI	Unc	Rio	SJu
Blue Spruce										ESC					
Englemann and White Spruce															
White Fir															
Subalpine Fir			XXX						XXX					XXX	
Narrowleaf Cottonwood															
Thinleaf Alder															
Maple, Dogwood, and Honeysuckle															
Montane Willow		XXX		XXX				XXX	XXX		XXX	XXX	XXX	XXX	XXX
Subalpine Willow and Birch											XXX	XXX		XXX	
Tufted Hairgrass, Reedgrass, Sedge, and Forb			XXX						XXX				XXX		

PLAINS GRASSLANDS (including parts of Black Hills and Nebraska National Forests)

SERIES	THU	BUF	FTP	OGL	BLH	NEB	PAW	COM	CIM
PLAINS UPLAND SERIES									
Short--Grass Plains								CAM	
Mid--Grass Prairie									
Tall--Grass Prairie						SIG			
Rocky Mountain and One-seeded Juniper									
Silver and Big Sagebrush									
Fourwing Saltbush									

PLAINS WETLAND AND RIPARIAN SERIES	THU	BUF	FTP	OGL	BLH	NEB	PAW	COM	CIM
Plains Cottonwood									
Green Ash and Eastern Hophornbeam									
Bur Oak									
Riparian Grassland					XXX				
Salt Flats									
Riparian Shrubland									
Greasewood									

* Abbreviation for the name of an established RNA which represents or probably represents this Series. See listing of established RNAs below.

The adequacy of Series representation for some of the established RNAs needs further evaluation.

** Shading indicates the occurrence of a targeted Series or Series group on a National Forest or Grassland. See 'Introduction to the RNA Matrix' for an explanation of RNA targeting.

These Series occurrences are based on our current knowledge of plant association and community type occurrences (see Appendix to RNA Matrix). This knowledge is incomplete.

*** The National Forests of Region 2 have been divided into 3 subdivisions and the Grasslands as a separate subdivision for the purpose of RNA targeting.

See 'Introduction to the RNA Matrix' for an explanation of how these divisions correspond to the Provinces and Sections of the Ecological Land Unit Map of Region 2.

**** The Series known for the San Isabel NF are listed for both north and south subdivisions until further information becomes available.

XXX Series which probably occur on National Forests or Grasslands but are not substantiated by plant association data.

Series and Series group names are taken from Johnston, B. 1987. Plant Associations of Region Two. Edition 4. Rocky Mountain Region. R2-ECOL-87-2 and Bourgeron, P.S. and L.D. Engelking, eds. 1993. A hierarchical classification of the western U.S. vegetation. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO.

An aquatic ecosystem classification will be added to this matrix in the future.

ESTABLISHED RESEARCH NATURAL AREAS IN THE ROCKY MOUNTAIN REGION

			<u>Acres</u>
BUL	Bull Elk Park	Bighorn NF	719
CAM	Campo	Comanche NG	35
ESC	Escalante Creek	GMUG NFs	44
GOT	Gothic	GMUG NFs	1050
HUR	Hurricane Canyon	Pike and San Isabel NFs	520
MTG	Mount Goliath	Arapaho and Roosevelt NFs	161
NAR	Narraquinnep	San Juan NF	1928
SAD	Saddle Mountain	Pike and San Isabel NFs	479
SHL	Shell Canyon	Bighorn NF	729
SIG	Signal Hill	Nebraska NF	699
SNO	Snowy Range	Medicine Bow NF	771
UPI	Upper Pine Creek	Black Hills NF	1191
WILL	Williams Creek	San Juan NF	544

At present there is very little known about the Series, plant associations, and community types on a number of these RNAs, some of which were established in the 1930s.

NATIONAL FORESTS OF THE ROCKY MOUNTAIN REGION

Arapaho and Roosevelt
Black Hills
Bighorn
Grand Mesa, Uncompahgre, and Gunnison
Medicine Bow
Nebraska
Pike and San Isabel
Rio Grande
Routt
San Juan
Shoshone
White River

NATIONAL GRASSLANDS OF THE ROCKY MOUNTAIN REGION

Buffalo Gap
Cimarron
Comanche
Ft. Pierre
Ogala
Pawnee
Thunder Basin

DRAFT – APPENDIX OF PLANT ASSOCIATIONS AND COMMUNITY TYPES FOR THE RNA MATRIX FOR THE ROCKY MOUNTAIN REGION

NATIONAL FORESTS (see page 10 for National Grasslands)

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	NEBR., S.DAKOTA & N. WYOMING***				SOUTHERN WYOMING AND NORTHERN COLORADO						SOUTHERN COLORADO					
UPLAND SERIES		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGM	NSI	SSI	Unc	Rio	SJu	
PONDEROSA PINE SERIES		***															
Ponderosa Pine	Pipo/Bocu (Pinus ponderosa/Bouteloua curtipendula)	0	0									****					
	Pipo/Cahe1 (Carex heliophila)	0	UPI*					0		0							
	Pipo/Dain (Danthonia intermedia)		0														
	Pipo/Pavi (Padus virginiana)	0	0														
	Pipo/Quma (Quercus macrocarpa)		0														
	Pipo/Scsc–Elsm (Schizachyrium scoparium–Elytrigia smithii)	0	0														
	Pipo/Syal (Symphoricarpos albus)	0	0														
	Pipo–Jusc/Cemo (Juniperus scopulorum/Cercocarpus montanus)		0														
	Pipo/Juco–Syal (Juniperus communis–Symphoricarpos albus)		0														
	Pipo/Feid (Festuca idahoensis)			0								0					
	Pipo/Juco (Juniperus communis)		0	0													
	Pipo/Phmo (Physocarpus monogynus)		0	0													
	Pipo/Rosp (Roegneria spicata)		0														
	Pipo/Spbe (Spiraea betulifolia)		0	0													
	Pipo–Jusc/Rosp (Juniperus scopulorum/Roegneria spicata)			0													
	Pipo/Arad (Arctostaphylos adenotricha)		0			0					0		0				
	Pipo/Bogr (Bouteloua gracilis)															0	
	Pipo/Scsc (Schizachyrium scoparium)														0	0	
	Pipo/Cage1 (Carex geyeri)					0	0	0	0								
	Pipo/Caro3 (Carex rossii)					0		0									
	Pipo/Cemo (Cercocarpus montanus)							0			0						
	Pipo/Fear1 (Festuca arizonica)										0	0	0	0		0	
	Pipo/Leki (Leucopoa kingii)								0								
	Pipo/Pied–Quga (Pinus edulis–Quercus gambellii)															0	
	Pipo/Quga (Quercus gambellii)									0	0	0	0	0	0		NAR
	Pipo/Putr (Purshia tridentata)								0								
	Pipo–JUNI/Bogr (Juniperus sp./Bouteloua gracilis)												0	0			0
	Pipo–Psme/Mumo1 (Pseudotsuga menziesii/Muhlenbergia montana)								0			0				0	0
Pipo/Arpa3 (Arctostaphylos patula)											0						
DOUGLAS–FIR SERIES										SAB							
Douglas–fir	Psme/Caro3 (Pseudotsuga menziesii/Carex rossii)							0									
	Psme/Arad–Juco (Arctostaphylos adenotricha–Juniperus communis)							0			0	0	0	0		0	
	Psme/Arpa3 (Arctostaphylos patula)														0		
	Psme/Cemo (Cercocarpus montanus)										0		0		0		
	Psme/Fear1 (Festuca arizonica)											0	0		0	0	
	Psme/Pamy (Paxistima myrsinites)						0			0		0					
	Psme/Jaam (Jamesia americana)							0			0						
	Psme/Putr (Purshia tridentata)										0						

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pk	GGM	NSI	SSI	Unc	Rlo	SJu
	Psme/Quga (Quercus gambelii)								0	0		0	0		0	0
	Psme/Phmo (Physocarpus monogynus)			SHL		0	0	0		0					0	
	Psme/Arco2 (Arnica cordifolia)			0	0											
	Psme/Caru1 (Calamagrostis rubescens)				0											
	Psme/Cage1 (Carex geyeri)				0			0			0					
	Psme/Feid (Festuca idahoensis)				0						0					
	Psme/Juco (Juniperus communis)			0	0											
	Psme/Mare (Mahonia repens)			0	0						0					
	Psme/Acgl (Acer glabrum)				0				0							
	Psme/Phma (Physocarpus malvaceus)				0											
	Psme/Spbe (Spiraea betulifolia)				0											
	Psme/Syal (Symphoricarpos albus)				0											
	Psme/Syor1 (Symphoricarpos oreophilus)			0	0		0	0	0		0					
	Psme/Vagl (Vaccinium globulare)				0											
BLUE SPRUCE SERIES						XXX	XXX	XXX	XXX	XXX						
Blue Spruce	Pipu-Psme/Arad (Picea pungens- -Pseudotsuga menziesii/Arctostaphylos adenotricha)														0	
	Pipu-Psme/Cafo (Carex foenea)															0
	Pipu-Psme/Erax (Erigeron eximius)											0	0		0	
	Pipu-Psme/Fear1 (Festuca arizonica)										0				0	0
	Pipu-Psme/Libo (Linnaea borealis)														0	0
	Pipu-Psme/Mare (Mahonia repens)															0
	Pipu/POA (Poa spp.)											0	0		0	0
WHITE FIR SERIES																
White Fir	Abco-Psme/Arad (Abies concolor-Pseudotsuga menziesii /Arctostaphylos adenotricha)														0	
	Abco-Psme/Erax (Erigeron eximius)															WILL
	Abco-Psme/Fear1 (Festuca arizonica)														0	
	Abco-Psme/Hodu (Holodiscus dumosus)														0	
	Abco-Psme/Quga (Quercus gambelii)															0
	Abco-Psme/sparse (sparse understory)											0	0		0	0
	Abco-Psme/Syor1 (Symphoricarpos oreophilus)											0	0			0
	Abco-Psme/Vamy (Vaccinium myrtillus)											0	0			0
	Abco-Pifi/Fear1 (Pinus flexilis/Festuca arizonica)															0
WHITE SPRUCE SERIES																
White Spruce	Pigl/Juco (Picea glauca/Juniperus communis)		0													
	Pigl/Libo (Linnaea borealis)		0													
LODGEPOLE PINE SERIES																
Lodgepole Pine	Pico/Arad (Pinus contorta/Arctostaphylos adenotricha)			0		0		0		0					0	
	Pico/Cage1 (Carex geyeri)					0		0	0		0					
	Pico/Caro3 (Carex rossii)				0	0										
	Pico/Juco (Juniperus communis)				0	0		0			0					
	Pico/Pone2 (Poa nervosa)				0											
	Pico/Shca (Shepherdia canadensis)				0	0	0	0	0							

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pk	GGI	NSI	SSI	Unc	Rio	SJu
	Pico/Vamy (<i>Vaccinium myrtillus</i>)							0			0					
	Pico/Vasc (<i>Vaccinium scoparium</i>)		0		0	0		0	0		0					
WHITEBARK PINE SERIES																
Whitebark Pine	Pial/Cage1 (<i>Pinus albicaulis</i> / <i>Carex geyeri</i>)				0											
	Pial/Caro3 (<i>Carex rossii</i>)				0											
	Pial/Feid (<i>Festuca idahoensis</i>)				0											
	Pial/Juco (<i>Juniperus communis</i>)				0											
	Pial/Vasc (<i>Vaccinium scoparium</i>)				0											
	Pial-Pifi/Podl (<i>Pinus flexilis</i> / <i>Potentilla diversifolia</i>)				0											
LIMBER PINE SERIES																
Limber Pine	Pifi/Capu1 (<i>Pinus flexilis</i> / <i>Calamagrostis purpurascens</i>)							0								
	Pifi/Cele (<i>Cercocarpus ledifolius</i>)			0												
	Pifi/Feid (<i>Festuca idahoensis</i>)				0											
	Pifi/Feth (<i>Festuca thurberi</i>)										0					
	Pifi/Juco (<i>Juniperus communis</i>)				0	0	0	0			0	0	0			
	Pifi/Lekl (<i>Leucopoa kingii</i>)				0	0										
	Pifi/Trda (<i>Trifolium dasyphyllum</i>)							0								
BRISTLECONE PINE SERIES																
Bristlecone Pine	Piar/Fear1 (<i>Pinus aristata</i> / <i>Festuca arizonica</i>)									0	0	0	0		0	
	Piar/Feth (<i>Festuca thurberi</i>)							0		0	0	0	0		0	
	Piar/Juco (<i>Juniperus communis</i>)										0					
	Piar/Rimo (<i>Ribes montigenum</i>)											0	0			
	Piar/Trda (<i>Trifolium dasyphyllum</i>)							MTG		0						
ENGLEMANN SPRUCE SERIES																
Englemann Spruce	Pien1/Arco2 (<i>Picea engelmannii</i> / <i>Arnica cordifolia</i>)				0											
	Pien1/Juco (<i>Juniperus communis</i>)				0											
	Pien1/Libo (<i>Linnaea borealis</i>)				0											
	Pien1/moss (moss understory)				0					0	0	0	0		0	0
	Pien1/Phma (<i>Physocarpus malvaceus</i>)				0											
	Pien1/Trda (<i>Trifolium dasyphyllum</i>)							0								
	Pien1/Vasc (<i>Vaccinium scoparium</i>)			0	0		0	0	0							0
	Pien1/Feth (<i>Festuca thurberi</i>)														0	
	Pien1/Vamy (<i>Vaccinium myrtillus</i>)											0	0		0	
SUBALPINE FIR SERIES																
Subalpine Fir	Abla/Cage1 (<i>Abies lasiocarpa</i> / <i>Carex geyeri</i>)							0			0					0
	Abla/Thfe1 (<i>Thalictrum fendleri</i>)															0
	Abla-Pien1/Acru (<i>Picea engelmannii</i> / <i>Actaea rubra</i>)				0											
	Abla-Pien1/Arco2 (<i>Arnica cordifolia</i>)			0	0						0					
	Abla-Pien1/Arla (<i>Arnica latifolia</i>)				0											
	Abla-Pien1/Caru1 (<i>Calamagrostis rubescens</i>)					0										
	Abla-Pien1/Cage1 (<i>Calamagrostis geyeri</i>)				0	0	0	0	0		0					
	Abla-Pien1/Juco (<i>Juniperus communis</i>)				0				0		0				0	0
	Abla-Pien1/Libo (<i>Linnaea borealis</i>)			0	0			0	0			0	0		0	0
	Abla-Pien1/Mare (<i>Mahonia repens</i>)				0											
	Abla-Pien1/moss (moss understory)					0		0			0					0

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGI	NSI	SSI	Unc	Rio	SJu
	Abla-Pien1/Pamy (Paxistima myrsinites)								0							
	Abla-Pien1/Pone2 (Poa nervosa)				0											
	Abla-Pien1/RIBE (Ribes spp.)			0	0				0	0	0					0
	Abla-Pien1/Sag1 (Salix glauca)							0	0	0	0					
	Abla-Pien1/Thoc (Thalictrum occidentale)				0											
	Abla-Pien1/Vace (Vaccinium cespitosum)					0										
	Abla-Pien1/Vagl (Vaccinium globulare)				0											
	Abla-Pien1/Vasc (Vaccinium scoparium)			0	0	0	0	0	0		0					0
	Abla-Pien1/Erex (Erigeron eximius)											0	0		0	0
	Abla-Pien1/Rupa (Rubus parviflorus)								0						0	0
	Abla-Pien1/Vamy (Vaccinium myrtillus)							0	0		0	0	0		0	0
ASPEN SERIES			XXX							SAB					XXX	
Aspen	Potr1/Artr (Populus tremuloides/Artemisia tridentata)				0											
	Potr1/Arad (Arctostaphylos adenotricha)										0					
	Potr1/Amal-Pavi (Amelanchier alnifolia-Padus virginiana)					0	0		0		0					
	Potr1/Caru1 (Calamagrostis rubescens)					0	0									
	Potr1/Cage1 (Carex geyeri)					0		0	0		0			0		0
	Potr1/Ceve (Ceanothus velutinus)						0									
	Potr1/Coco (Corylus cornuta)			0						0						
	Potr1/Fear1 (Festuca arizonica)										0					
	Potr1/Feth (Festuca thurberi)						0	0	0		0			0		
	Potr1/Hesp (Heracleum sphondylium)						0		0							
	Potr1/Juco (Juniperus communis)				0	0										
	Potr1/Lale (Lathyrus leucanthus)					0	0	0								
	Potr1/LIGU (Ligusticum spp.)					0	0	0	0		0	0	0	0		0
	Potr1/Luar1 (Lupinus argenteus)			0	0											
	Potr1/Ptaq (Pteridium aquilinum)						0		0		0					
	Potr1/Syor1 (Symphoricarpos oreophilus)				0		0		0		0					0
	Potr1/Thfe1 (Thalictrum fendleri)				0		0	0	0		0					
	Potr1/Vete (Veratrum tenuipetalum)						0	0								0
JUNIPER AND PINYON SERIES																XXX
Utah Juniper	Juos/Artr (Juniperus osteosperma/Artemisia tridentata)			0												
	Juos/Cemo-Pera2 (Cercocarpus montanus -Peraphyllum ramosissimum)								0							
	Juos/Mafr (Mahonia fremontii)										0					
One-seeded Juniper	Juos/Orhy (Oryzopsis hymenoides)								0		0			0		0
	Juos-Pied/Rosp (Pinus edulis/Roegneria spicata)								0		0			0		
	Jumo/Bocu (Juniperus monosperma/Bouteloua curtipendula)											0	0		0	
Pinyon Pine	Jumo/Bogr (Bouteloua gracilis)											0	0		0	
	Pied/Bogr (Pinus edulis/Bouteloua gracilis)											0	0		0	
	Pied-Jumo/Cemo (Juniperus monosperma/Cercocarpus montanus)											0	0		0	
	Pied/Quga (Quercus gambelii)								0							0
	Pied-Juos/Artr (Juniperus osteosperma/Artemisia tridentata)								0		0			0		0
	Pied-Juos/Amut-Cemo (Amelanchier utahensis-C. montanus)								0							

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Plk	GGH	NSI	SSI	Unc	Rio	SJu
ROCKY MOUNTAIN JUNIPER SERIES																
Rocky Mountain Juniper	Jusc/Artr (Juniperus scopulorum/Artemisia tridentata)			0				0								
	Jusc/Cemo (Cercocarpus montanus)							0								
	Jusc/Eism (Elytrigia smithii)				0											
	Jusc/Putr (Purshia tridentata)							0								
	Jusc/Rosp (Roegneria spicata)			SHL	0	0	0	0								
MOUNTAIN MAHOGANY AND SKUNKBRUSH SERIES																
Mountain Mahogany	Cele/Rosp (Cercocarpus ledifolius/Roegneria spicata)			0												
	Cemo/Elda (Cercocarpus montanus/Elytrigia dasystachya)							0								
	Cemo-Rhart/Bocu (Rhus aromatica/Bouteloua curtipendula)		0													
	Cemo/Mumo1 (Muhlenbergia montana)									0						
	Cemo/Stco1 (Stipa comata)							0								
Skunkbrush	Rhart/Mumo1 (Rhus aromatica spp. trilobata/Muhlenbergia montana)										0					
	Rhart/Rosp (Roegneria spicata)				0											
GAMBEL OAK SERIES																
Gambel Oak	Quga/Amal (Quercus gambellii/Amelanchier alnifolia)						0		0		0			0		0
	Quga/Amut (Amelanchier utahensis)															NAR
	Quga/Cemo (Cercocarpus montanus)										0	0		0		0
	Quga-Pavi/Feth (Padus virginianus/Festuca thurberi)									0						
	Quga-Pavi/Pamy (Paxistima myrsinites)						0		0		0					
	Quga/Syor1 (Symphoricarpos oreophilus)					0	0		0		0			0		NAR
SERVICEBERRY, CHOKECHERRY, SNOWBERRY, AND SHRUBBY CINQUEFOIL SERIES																
Serviceberry	Amal-Pavi/Viam (Amelanchier alnifolia-Padus virginianus/Vicia americana)						0				0					
	AMEL/Cage1 (Amelanchier spp./Carex geyeri)					0	0	0	0							
	AMEL-Putr/Rosp (Purshia tridentata/Roegneria spicata)					0										
Chokecherry	AMEL/Syor1-Artr (Symphoricarpos oreophilus-Artemisia tridentata)			0	0	0			0		0					
	Pavi-Syor1/Eitr (Padus virginiana-Symphoricarpos oreophilus/Elymus trachycaulus)										0					
	Syor1/Feth (Symphoricarpos oreophilus/Festuca thurberi)							0			0					
Snowberry Shrubby Cinquefoil	Pefi/Feld (Pentaphylloides floribunda/Festuca idahoensis)			0							0					
	Pefi/Feth (Festuca thurberi)								0		0					
	Pefi/Fesc (Festuca scabrella)			0												
	Pefi/Ciau (Ciliaria austromontana)										0					
ROCK, SCREE, AND CLIFF VEGETATION SERIES																
Ocean-spray	Hodu/Feth (Holodiscus dumosus/Festuca thurberi)										0					
	Hodu/Rice (Ribes cereum)										0					
Juniper-Currant	Juco-RIBE/Feth (Juniperus communis-Ribes spp./Festuca thurberi)										0					
Wax Currant	Rice/Feld (Ribes cereum/Festuca idahoensis)										0					
Gooseberry Currant	Rimo/Aqco (Ribes montigenum/Aquilegia coerulea)							0								
	Rimo/Popu1 (Polemonium pulcherimum)										0					
Red Raspberry	Ruid/Aqco (Rubus idaeus/Aquilegia coerulea)							0			0					
	Ruid/Hepa2 (Heuchera parvifolia)										0					
Senecio atratus	Seat/Phhe (Senecio atratus/Phacelia heterophylla)										0					

		Neb	BIH	BgH	Sho	MedRou	ArR	Whi	Pik	GGF	NSI	SSI	Unc	Rio	SJu
BIG SAGEBRUSH SERIES															
Big Sagebrush	Artr/Feid (Artemisia tridentata/Festuca idahoensis)			0	0	0	0	0	0	0					
	Artr/Feth (Festuca thurberi)					0	0	0		0					
	Artr/Leam (Leymus ambiguus)						0								
	Artr/Leci (Leymus cinereus)				0		0								
	Artr/Leki (Leucopoa kingii)						0								
	Artr/Orhy (Oryzopsis hymenoides)					0?		0?							
	Artr-Chvi3/LUPI (Chrysothamnus viscidiflorus/Lupinus sp.)					0		0							
	Artr-Putr/Elda (Purshia tridentata/Elytrigia dasystachya)				0										
	Artr-Putr/Elsm (Elytrigia smithii)					0		0							
	Artr/Rosp (Roegneria spicata)			0	0	0	0								
	Artr/Stco1 (Stipa comata)	0					0								
	Artr/Stne (Stipa nelsoniana)					0	0								
LOW, ALKALI, AND THREETIP SAGEBRUSH SERIES															
Low Sagebrush	Arar3/Feid (Artemisia arbuscula/Festuca idahoensis)			0	0										
	Arar3/Rosp (Roegneria spicata)				0										
Alkali Sagebrush	Arlo3/Elsm (Artemisia longiloba/Elytrigia smithii)				0										
	Arlo3/Rosp (Roegneria spicata)					0									
Threetip Sagebrush	Artr1/Feid (Artemisia tripartita/Festuca idahoensis)				0	0		0							
	Artr1/Pose (Poa secunda)				0										
BITTERBRUSH SERIES															
Bitterbrush	Putr/Rosp (Purshia tridentata/Roegneria spicata)				0										
	Putr-Artr/Rosp (Artemisia tridentata/Roegneria spicata)					0									
	Putr-Artr/Feid (Festuca idahoensis)				0	0	0	0		0					
	Putr/Mumo1 (Muhlenbergia montana)							0							
	Putr/Stco1 (Stipa comata)							0							
BLACK AND SILVER SAGEBRUSH SERIES															
Black Sagebrush	Arno/Basa2 (Artemisia nova/Balsamorhiza sagittata)							0							
	Arno/Rosp (Roegneria spicata)			SHL	0										
Silver Sagebrush	Arca3/Feld (Artemisia cana/Festuca idahoensis)					0	0	0		0					
	Arca3/Feth (Festuca thurberi)						0	0		0					
	Arca3/Elsm (Elytrigia smithii)					0									
ROUGH AND IDAHO FESCUE SERIES															
Rough Fescue Idaho Fescue	Fesc/Feid (Festuca scabrella/Festuca idahoensis)				0										
	Feld/Caob (Festuca idahoensis/Carex obtusata)			0											
	Feld/Dece (Deschampsia cespitosa)				0										
	Feld/Eitr (Elymus trachycaulus)							0		0					
	Feld/Elsm (Elytrigia smithii)				0										
	Feld/Gevi (Geranium viscosissimum)							0							
	Feld/Leki (Leucopoa kingii)			BUL											
	Feld/Luse (Lupinus sericeus)			0	0										
	Feld/Rosp (Roegneria spicata)			BUL	0										
	Feld/Trsp (Trisetum spicatum)				0										

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGI	NSI	SSI	Unc	Rio	SJu
THURBER FESCUE AND PORTER LIGUSTICUM SERIES																
Thurber Fescue	Feth/Dapa1 (Festuca thurberi/Danthonia parryi)									0	0					
	Feth/Fear1 (Festuca arizonica)										0	0	0		0	
	Feth/Feid (Festuca idahoensis)						0	0	0		0					
	Feth/Oral (Oreoxis alpina)										0					
Porter Ligusticum	Feth/Viam-Lale (Vicia americana-Lathyrus leucanthus)							0	0		0					
	Lipo/Lupa3 (Ligusticum porteri/Lupinus parviflorus)						0	0	0		0					
	Lipo/Viam (Vicia americana)								0							
PARRY OATGRASS, ARIZONA FESCUE, MUHLY, AND BLUE GRAMA SERIES																
Parry Oatgrass	Dapa1/Cahe1 (Danthonia parryi/Carex heliophila)							0		SAD?						
	Dapa1/Fear1 (Festuca arizonica)										0					
	Dapa1/Feld (Festuca idahoensis)					0					0					
Arizona Fescue	Fear1/Cahe1 (Festuca arizonica/Carex heliophila)														0	
	Fear1/Mumo1 (Muhlenbergia montana)									0	0	0	0		0	
Slmstem Muhly	Mufi1/Arfr1 (Muhlenbergia filiculmis/Artemisia frigida)														0	
	Mumo1/Elda (Muhlenbergia montana/Elytrigia dasystachya)							0								
Mountain Muhly	Mumo1/Bltr (Blepharoneuron tricholepis)											0	0		0	
	Mumo1/Fear1 (Festuca arizonica)									0	0				0	
	Mumo1/Mela (Mertensia lanceolata)										0					
	Bogr/Atca (Bouteloua gracilis/Atriplex canescens)														0	
	Bogr/Mufi1 (Muhlenbergia filiculmis)														0	
	Bogr/STIP (Stipa spp.)											0	0			
BLUEBUNCH WHEATGRASS AND NEEDLE-AND-THREAD SERIES																
Bluebunch Wheatgrass	Rosp/Pose (Roegneria spicata/Poa secunda)				0	0		0	0							
	Rosp/Elsm (Elytrigia smithii)				0											
	Rosp/Pofe (Poa fendleriana)							0								
	Rosp/Stco1 (Stipa comata)				0											
Needle-and-thread	Stco1/Bogr (Stipa comata/Bouteloua gracilis)		0			0		0								
	Stco1/Mumo1 (Muhlenbergia montana)							0								
	Stco1/Caeb (Carex ebenea)					0										
TIMBER OATGRASS SERIES																
Timber Oatgrass	Dairv/Dece (Danthonia intermedia/Deschampsia cespitosa)										0					
	Dairv/Podi (Potentilla diversifolia)			0?				0	0		0					
	Dairv/Stle (Stipa lettermanii)										0					
ALPINE GRASSLAND AND RIDGE SERIES				XXX			XXX				GO					
Water Sedge	Caaq/Pegr1 (Carex aquatilis/Pedicularis groenlandica)							0			0					
Capillaris Sedge	Caca3/BM (Carex capillaris/Bistorta vivipara)							0								
Elynoides Sedge	Cael/Acro (Carex elynoides/Acomastylis rossii)										0					
	Cael/OREO (Oreoxis sp.)							0			0					
	Cael/Sede (Selaginella densa)										0					
	Cael/Trda (Trifolium dasyphyllum)							0			0					0
Engelmann Sedge	Caen/Saren (Carex engelmannii/Salix reticulata spp. nivalis)										0					
Cloud Sedge	Caha/Poar2 (Carex haydeniana/Poa arctica)							0			0					
Microglochin Sedge	Cam13/BM (Carex microglochin/Bistorta vivipara)							0								
Black Alpine Sedge	Can1/JUNC (Carex nigricans/Juncus spp.)				0			0			0					0

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGI	NSI	SSI	Unc	Rio	SJu
Pyrenees Sedge	Capy/Erme (<i>Carex pyrenaica</i> / <i>Erigeron melanocephalus</i>)							0			0					
Cliff Sedge	Casc2/Acro (<i>Carex scopulorum</i> / <i>Acomastylis rossii</i>)				0											
	Casc2/Bivi (<i>Bistorta vivipara</i>)										0					
	Casc2/Cale1 (<i>Caltha leptosepala</i>)				0			0	0		0					0
	Casc2/Dece (<i>Deschampsia cespitosa</i>)				0											
	Casc2/moss (moss)				0											
Foenea Sedge	Cafo/Acro (<i>Carex foenea</i> / <i>Acomastylis rossii</i>)							0			0					
Præceptorum Sedge	Capr1/Caaq (<i>Carex præceptorum</i> / <i>Carex aquatilis</i>)										0					
Arctic Poa	Poar2/BM (<i>Poa arctica</i> / <i>Bistorta vivipara</i>)										0					
Tufted Hairgrass	Dece/Acro (<i>Deschampsia cespitosa</i> / <i>Acomastylis rossii</i>)				0	0		0	0	0	0					
	Dece/Judr (<i>Juncus drummondii</i>)										0					
Kobresia	Komy/Trda (<i>Kobresia myosuroides</i> / <i>Trifolium dasyphyllum</i>)							0		0						
	Komy/Acro – Caru (<i>Acomastylis rossii</i> – <i>Carex rupestris</i>)				0			0	0	0	0	0	0			0
	Komy/Trna (<i>Trifolium nanum</i>)									0						0
	Kosi/BM (<i>Kobresia sibirica</i> / <i>Bistorta vivipara</i>)							0			0					
Golden Avens	Acro/Bibi2 (<i>Acomastylis rossii</i> / <i>Bistorta bistortoides</i>)				0			0	0	0	0					0
	Acro/Caru (<i>Carex rupestris</i>)				0				0							
	Acro/Poar2 (<i>Poa arctica</i>)															0
	Acro/Trda (<i>Trifolium dasyphyllum</i>)				0	0										
	Acro/Trna (<i>Trifolium nanum</i>)				0											
	Acro/TRIF – Dece (<i>Trifolium</i> sp. – <i>Deschampsia cespitosa</i>)				0	0		0								0
Pussytoes	Anme/Poar2 (<i>Antennaria media</i> / <i>Poa arctica</i>)							0			0					
Marsh – Marigold	Cale1/Cirh (<i>Caltha leptosepala</i> / <i>Clementia rhodantha</i>)							0			0					0
Alpine Thistle	Cisc/Aqco (<i>Cirsium scopulorum</i> / <i>Aquilegia coerulea</i>)							0								
Alpine Spring – Beauty	Cime/Sasa (<i>Claytonia megarhiza</i> / <i>Sagina saginoides</i>)							0								
	Cime/Siac (<i>Silene acaulis</i>)							0								
False Buckwheat	Erco3/Oxde (<i>Eriogonum coloradense</i> / <i>Oxytropis deflexa</i>)										0					
Alpine Parsley	Orba/Saar – Sede (<i>Oreoxis bakeri</i> / <i>Salix arctica</i> – <i>Selaginella densa</i>)															0
Double Bladder – pod	Phal/Peha (<i>Physaria alpina</i> / <i>Penstemon harbourii</i>)										0					
Sibbaldia	Sipr/Capy (<i>Sibbaldia procumbens</i> / <i>Carex pyrenaica</i>)							0								
	Sipr/Libi – moss (<i>Lidia biflora</i> – moss)							0			0					
Sky Pilot	Povi/Erpl (<i>Polemonium viscosum</i> / <i>Erigeron pinnatisectus</i>)										0					
	Povi/Phse – Cisc (<i>Phacelia sericea</i> – <i>Cirsium scopulorum</i>)							0								
Snow Willow	Saren/Acro (<i>Salix reticulata</i> spp. <i>nivalis</i> / <i>Acomastylis rossii</i>)										0			0		
	Saren/Vace (<i>Vaccinium cespitosum</i>)										0					
Arctic Willow	Saar/Acro (<i>Salix arctica</i> / <i>Acomastylis rossii</i>)				0			0	0							
	Saar/Erme (<i>Erigeron melanocephalus</i>)										0					
	Saar/Trpa (<i>Trifolium parryi</i>)										0					
Parry Clover	Trpa/Dece (<i>Trifolium parryi</i> / <i>Deschampsia cespitosa</i>)				0			0			0				0	
	Trpa/Raad (<i>Ranunculus adoneus</i>)							0								
Valerian	Vaca2/Cebe2 (<i>Valeriana capitata</i> / <i>Cerastium beeringianum</i>)									0						
ALPINE FELLFIELD SERIES				XXX		XXX	XXX					XXX	XXX	XXX	XXX	
Arapaho Sedge	Caar3/Libi (<i>Carex arapahoensis</i> / <i>Lidia biflora</i>)							0								
Spikenard Sedge	Cana/Beal (<i>Carex nardina</i> / <i>Besseyia alpina</i>)							0			0					
Mt. Baldy Sedge	Cape1/Siac (<i>Carex perglobosa</i> / <i>Silene acaulis</i>)							0	0							

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGI	NSI	SSI	Unc	Rio	SJu
Curly Sedge	Caru/Komy (<i>Carex rupestris</i> / <i>Kobresia myosuroides</i>)										0					
	Caru/Libi (<i>Lidia biflora</i>)							0			0					
	Caru/Phsi (<i>Phlox sibirica</i>)				0											
	Caru/Trda (<i>Trifolium dasyphyllum</i>)							0								
Mountain Dryad Alumroot	Droc/Caru (<i>Dryas octopetala</i> / <i>Carex rupestris</i>)							0	0		0					
	Hebr-Hepa2/Erpi2 (<i>Heuchera bracteata</i> - <i>Heuchera parvifolia</i> / <i>Erigeron pinnatisectus</i>)							0								
Gordon Ivesia	Ivgo/Erfe (<i>Ivesia gordonii</i> / <i>Eremogone fendleri</i>)										0					
Drummond Rush	Judr/Sipr (<i>Juncus drummondii</i> / <i>Sibbaldia procumbens</i>)							0			0					
Rocky Mtn. Nailwort	Papu/Libi (<i>Paronychia pulvinata</i> / <i>Lidia biflora</i>)							0								
Alpine phlox	Phsi/Trda (<i>Phlox sibirica</i> / <i>Trifolium dasyphyllum</i>)									0						
Serpyllifolia Saxifrage	Sase/Febr (<i>Saxifraga serpyllifolia</i> / <i>Festuca brachyphylla</i>)							0								
Smelowskia	Smca/Arbo (<i>Smelowskia calycina</i> / <i>Artemisia borealis</i>)										0					
Whiproot Clover	Trda/Caru (<i>Trifolium dasyphyllum</i> / <i>Carex rupestris</i>)									0						
	Trda/Eisc (<i>Elymus scribneri</i>)									0						
	Trda/Libi (<i>Lidia biflora</i>)							0			0					
Dwarf Clover	Trna/Erpi2 (<i>Trifolium nanum</i> / <i>Erigeron pinnatisectus</i>)										0					
	Trna/Libi (<i>Lidia biflora</i>)				0			0	0		0					
Parry Clover	Trpa/Acro (<i>Trifolium parryi</i> / <i>Acomastylis rossii</i>)							0			0					0

WETLAND AND RIPARIAN SERIES		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Pik	GGI	NSI	SSI	Unc	Rio	SJu
BLUE SPRUCE SERIES																
Blue Spruce	Pipu/Alint (<i>Picea pungens</i> / <i>Alnus incana</i> spp. <i>tenuifolia</i>)				0		0								0	
	Pipu/Amal-Swse (<i>Amelanchier alnifolia</i> - <i>Swida sericea</i>)						0		0		ESC					0
	Pipu/Arco2 (<i>Arnica cordifolia</i>)			0		0		0			ESC					
	Pipu-Pien1/Egar (<i>Picea engelmannii</i> / <i>Equisetum arvense</i>)				0											
ENGLEMANN AND WHITE SPRUCE SERIES																
Engelmann Spruce	Pien1/Cale1 (<i>Picea engelmannii</i> / <i>Caltha leptosepala</i>)				0											
	Pien1/Cadl (<i>Carex disperma</i>)		0		0											
	Pien1-Pipu/Gatr2 (<i>Picea pungens</i> / <i>Galium triflorum</i>)				0											
White Spruce	Pigl/Cape4 (<i>Picea glauca</i> / <i>Carex peckii</i>)		0													
WHITE FIR SERIES																
White Fir	Abco-Psme/Acg1 (<i>Abies concolor</i> - - <i>Pseudotsuga menziesii</i> / <i>Acer glabrum</i>)										0	0			0	0
	Abco-Psme/Quqa (<i>Quercus gambelii</i>)															0
SUBALPINE FIR SERIES				XXX						XXX					XXX	
Subalpine Fir	Abla-Pien1/Caca (<i>Abies lasiocarpa</i> - - <i>Picea engelmannii</i> / <i>Calamagrostis canadensis</i>)				0	0	0	0	0		0					
	Abla-Pien1/Mec1 (<i>Picea engelmannii</i> / <i>Mertensia ciliata</i>)											0	0			0
	Abla-Pien1/Setr (<i>Picea engelmannii</i> / <i>Senecio triangularis</i>)				0		0	0	0		0					
NARROWLEAF COTTONWOOD SERIES																
Narrowleaf Cottonwood	Poan3/Amal (<i>Populus angustifolia</i> / <i>Amelanchier alnifolia</i>)								0							
	Poan3/Alint-Swse (<i>Alnus incana</i> spp. <i>tenuifolia</i> - <i>Swida sericea</i>)										0					
	Poan3/Befo-RIBE (<i>Betula fontinalis</i> - <i>Ribes</i> spp.)			0												

		Neb	BIH	BgH	Sho	Med	Rou	ArR	Whi	Plk	GGF	NSI	SSI	Unc	Rio	SJu
	Poan3-Pien1/Diin (<i>Picea engelmannii</i> /Distegia involucrata)															0
	Poan3/Phmo-Pavi (<i>Physocarpus monogynus</i> - <i>Padus virginiana</i>)			0												
	Poan3/Saex-Befo (<i>Salix exigua</i> - <i>Betula fontinalis</i>)			0	0	0		0			0					
THINLEAF ALDER SERIES																
Thinleaf Alder	Alint/Swse (<i>Alnus incana</i> spp. <i>tenuifolia</i> /Swida sericea)										0					
	Alint-Sadr/Eqar (<i>Salix drummondii</i> /Equisetum arvense)										0					
	Alint-Befo/SALI (<i>Betula fontinalis</i> /Salix spp.)				0	0		0								
MAPLE, DOGWOOD, AND HONEYSUCKLE SERIES																
Rocky Mountain Maple	Acgl/Swse (<i>Acer glabrum</i> /Swida sericea)										0					
Red-osier Dogwood	Swse/Diin (<i>Swida sericea</i> /Distegia involucrata)										0					
	Swse/Riin (<i>Ribes inerme</i>)										0					
Bearberry Honeysuckle	Diin/Caca (<i>Distegia involucrata</i> /Calamagrostis canadensis)										0					
MONTANE WILLOW SERIES			XXX		XXX				XXX	XXX		XXX	XXX	XXX	XXX	XXX
Peachleaf Willow	Saam-Saphp/Ashe (<i>Salix amygdaloides</i> - - <i>Salix phylicifolia</i> spp. <i>planifolia</i> /Aster hesperius)			0												
Drummond Willow	Sadr/Caca (<i>Salix drummondiana</i> /Calamagrostis canadensis)										0					
Coyote Willow	Saex-SALI/POA (<i>Salix exigua</i> - <i>Salix</i> spp./ <i>Poa</i> sp.)					0?										
Geyer Willow	Sage-SALI/Caca (<i>Salix geyeriana</i> - <i>Salix</i> spp./ Calamagrostis canadensis)			0		0	0	0			0					
	Sage-SALI/Caut (<i>Salix</i> spp./ <i>Carex utriculata</i>)						0	0								
SUBALPINE WILLOW AND BIRCH SERIES												XXX	XXX		XXX	
Grayleaf Willow	Sagl1/Acro (<i>Salix glauca</i> /Acomastylis rossii)							0								
	Sagl1-SALI/CARE (<i>Salix</i> spp./ <i>Carex</i> spp.)									0						
Planeleaf Willow	Sagl1-Sabr1/Dece (<i>Salix brachycarpa</i> /Deschampsia cespitosa)							0	0		0					0
	Saphp/Cale1 (<i>Salix phylicifolia</i> spp. <i>planifolia</i> /Caltha leptosepala)								0		0					
	Saphp/Caaq (<i>Carex aquatilis</i>)			0		0	0	0		0	0					
	Saphp/Casc2 (<i>Carex scopulorum</i>)							0	0		0					0
	Saphp/Dece (<i>Deschampsia cespitosa</i>)				0			0								
Bog Birch	Begl/Casc2 (<i>Betula glandulosa</i> /Carex scopulorum)										0					
	Begl/Popul (<i>Polemonium pulcherrimum</i>)										0					
TUFTED HAIRGRASS, REEDGRASS, SEDGE AND FORB SERIES				XXX						XXX				XXX		
Bluejoint Reedgrass	Caca-Casc2/Meci (<i>Calamagrostis canadensis</i> - <i>Carex scopulorum</i> / Mertensia ciliata)							0			0					
Reedgrass	Capu/Pogl (<i>Calamagrostis purpurascens</i> /Poa glauca)										0					
	Capu/Hemo (<i>Helictotrichon mortonianum</i>)										0					
Tufted Hairgrass	Dece/Cale1 (<i>Deschampsia cespitosa</i> /Caltha leptosepala)							0	0		0	0	0		0	
	Dece/CARE (<i>Carex</i> spp.)				0	0					0					
	Dece/Eitr (<i>Elymus trachycaulus</i>)										0					
Mountain Bluebells	Meci/Dece (<i>Mertensia ciliata</i> /Deschampsia cespitosa)							0			0					
Nebraska Sedge	Cane/Dece (<i>Carex nebrascensis</i> /Deschampsia cespitosa)			0												
Water Sedge	Caaq/Caut (<i>Carex aquatilis</i> /Carex utriculata)					0	0	0	0		0					
	Caaq/Caho1 (<i>Carex hoodii</i>)										0					
Catabrosa	Caaq1/Caaq (<i>Catabrosa aquatica</i> /Carex aquatilis)										0					
Common Spikesedge	Elpa/CARE (<i>Eleocharis palustris</i> /Carex spp.)				0	0										0
Baltic Rush	Juar/CARE (<i>Juncus arcticus</i> /Carex spp.)						0	0			0					

		Neb	BIH	BgH	Sho	MedRou	ArR	Whi	Pik	GGM	NSI	SSI	Unc	Rio	SJu
Drummond Rush	Judr/CARE (Juncus drummondii/Carex spp.)													0	
Bitter-Cress	Caco2/Cale1 (Cardamine cordifolia/Caltha leptosepala)						0								
Parry Primrose	Prpa2/Dece (Primula parryi/Deschampsia cespitosa)						0			0					
Brook Saxifrage	Saad/Dece (Saxifraga odontoloma/Deschampsia cespitosa)						0								
Golden Ragwort	Setr/Lifl (Senecio triangularis/Ligusticum filicinum)						0								
Sibbaldia	Sipr/Caeb (Sibbaldia procumbens/Carex ebenea)					0									
Corn Lily	Vete/Hesp (Veratrum tenuipetalum/Heracleum sphondylium)									0					

PLAINS GRASSLANDS (including parts of Black Hills and Nebraska National Forests)

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	THU	BUF	FTP	OGLBLH	NEBPAW	CONCIM
PLAINS UPLAND SERIES							
SHORT-GRASS PLAINS SERIES							
Blue Grama Series	Bogr/Cael1 (Bouteloua gracilis/Carex eleocharis)		0				
	Bogr/Elsm (Elytrigia smithii)	0			0	0	0
	Bogr/Eula1 (Eurotia lanata)	0					
	Bogr/Stco1 (Stipa comata)	0	0	0	0	0?	
	Bogr/Buda (Buchloe dactyloides)				0	0	CAN 0
	Bogr/Bocu (Bouteloua curtipendula)						0 0
	Bogr/Cahe1 (Carex heliophila)					0	
Buffalo Grass	Buda/CARE (Buchloe dactyloides/Cares spp.)					0	
	Buda/Elsm (Elytrigia smithii)	0	0	0	0	0?	0?
Needle and Thread	Stco1/Bogr (Stipa comata/Bouteloua gracilis)	0				0	
MID-GRASS PRAIRIE SERIES							
Sideoats Grama	Bocu/Scsc (Bouteloua curtipendula/Schizachyrium scoparium)						0 0
Western Wheatgrass	Elsm/Bogr (Elytrigia smithii/Bouteloua gracilis)	0	0		0	0	
	Elsm/Elac (Elytrigia smithii/Eleocharis acicularis)	0					
	Elsm/Stvl (Stipa viridula)		0	0			
	Elsm/Cahe1 (Elytrigia smithii/Carex heliophila)					0	
Bluebunch Wheatgrass	Rosp/Pose (Roegneria spicata/Poa secunda)	0					
	Rosp/Bogr (Bouteloua gracilis)	0					
	Rosp/Elsm (Elytrigia smithii)	0					
Stonyhills Muhly Series	Mucu/Scsc (Muhlenbergia cuspidata/Schizachyrium scoparium)	0?					
Little Bluestem Series	Scsc/Bocu (Schizachyrium scoparium/Bouteloua curtipendula)	0					
	Scsc/Bogr (Bouteloua gracilis)	0			0		
Alkali Sacaton Series	Spai/Elsm (Sporobolus airoides/Elytrigia smithii)						0 0
Prairie Dropseed Series	Sphe/CARE (Sporobolus heterolepis/Carex spp.)				0		
TALL-GRASS PRAIRIE SERIES							
Big Bluestem	Ange/Soav (Andropogon gerardii/Sorghastrum avenaceum)					0	
	Ange/Scsc (Schizachyrium scoparium)	0	0	0	0	0	0 0
Tall Dropseed	Spas/Scsc (Sporobolus asper/Schizachyrium scoparium)					0	
Sand Bluestem	Anha/Calo (Andropogon hallii/Calamovilfa longifolia)					0	
Prairie Sandreed	Calo/Stco1 (Calamovilfa longifolia/Stipa comata)	0					

		THU	BUF	FTP	OGLBLH	NEEPAW	CONCIM
Sand Sagebrush	Calo/Bogr (<i>Bouteloua gracilis</i>)					SIG	
	Calo/Spgr (<i>Sporobolus cryptandrus</i>)					O	
	Arfi/Anha (<i>Artemisia filifolia/Andropogon hallii</i>)						O O
	Arfi/Spgr-Bogr (<i>Sporobolus cryptandrus-Bouteloua gracilis</i>)						O
ROCKY MOUNTAIN AND ONE-SEEDED JUNIPER SERIES							
Rocky Mountain Juniper	Jusc/Ormi (<i>Juniperus scopulorum/Oryzopsis micrantha</i>)		O				
One-seeded Juniper	Jumo/Bogr (<i>Juniperus monosperma/Bouteloua gracilis</i>)						O
SILVER AND BIG SAGEBRUSH SERIES							
Silver Sagebrush Series	Arca3/Elsm (<i>Artemisia cana/Elytrigia smithii</i>)	O	O	O	O	O	
Big Sagebrush Series	Artr/Chna (<i>Artemisia tridentata/Chrysothamnus nauseosus</i>)	O					
	Artr/Elsm (<i>Elytrigia smithii</i>)	O					
	Artr/Rosp (<i>Roegneria spicata</i>)	O					
	Artr/Stco1 (<i>Stipa comata</i>)	O				O	
FOURWING SALTBUUSH SERIES							
Fourwing Saltbush Series	Atca/Bogr (<i>Atriplex canescens/Bouteloua gracilis</i>)						O
	Atca/Elsm-Bogr (<i>Elytrigia smithii-Bouteloua gracilis</i>)					O	
Shadscale Series	Atca-Atco/Spai (<i>Atriplex confertifolia/Sporobolus airoides</i>)						O

PLAINS WETLAND AND RIPARIAN SERIES		THU	BUF	FTP	OGLBLH	NEEPAW	CONCIM
PLAINS COTTONWOOD SERIES							
Plains Cottonwood	Posa/Riam (<i>Populus sargentii/Ribes americanum</i>)					O	
	Posa/Syoc-Lecl (<i>Symphoricarpos occidentalis-Leymus cinereus</i>)	O					
	Posa-Poan3/SALI (<i>Populus angustifolia/Salix spp.</i>)				O		
GREEN ASH AND EASTERN HOPHORNBEAM SERIES							
Green Ash	Frpe/Pav1 (<i>Fraxinus pennsylvanica/Padus virginiana</i>)	O					
	Frpe/Syoc (<i>Symphoricarpos occidentalis</i>)				O	O	
Eastern Hophornbeam	Osvi/Crsu (<i>Ostrya virginiana/Crataegus succulenta</i>)				O	O	
	Osvi-Quma/sparse (<i>Quercus macrocarpa/sparse understory</i>)				O		
BUR OAK SERIES							
Bur Oak	Quma/Cory3 (<i>Quercus macrocarpa/Corylus spp.</i>)	O					
	Quma/Syoc (<i>Symphoricarpos occidentalis</i>)				O		
RIPARIAN GRASSLAND SERIES					XXX		
Bluejoint Reedgrass	Caca/Casa2 (<i>Calamagrostis canadensis/Carex sartwellii</i>)					O	
Common Reedgrass	Phco/Cala1 (<i>Phragmites communis/Carex lacustris</i>)					O	
American Bulrush	Scam/CARE (<i>Scirpus americanus/Carex spp.</i>)	O					
Cat-tail	Tyla/Sala (<i>Typha latifolia/Sagittaria latifolia</i>)					O	
SALT FLAT SERIES							
Saltgrass	Disp/Pual (<i>Distichlis spicata/Puccinellia airoides</i>)	O	O	O	O	O	
	Disp/Spai-Elsm (<i>Sporobolus airoides-Elytrigia smithii</i>)	O					O
Western Wheatgrass	Elsm/Disp (<i>Elytrigia smithii/Distichlis spicata</i>)	O	O	O	O		O
RIPARIAN SHRUBLAND SERIES							
Meadow Willow	Sape1/Thpa1 (<i>Salix petiolaris/Helypteris palustris</i>)					O	
Eastern Hophornbeam	Osvi/Crsu (<i>Ostrya virginiana/Crataegus succulenta</i>)				O	O	
	Osvi-Quma/sparse (<i>Quercus macrocarpa/sparse understory</i>)				O		

		THU	BUF	FTP	OGLBLH	NEBPAW	CONCIM
Green Ash	Frpe/Syoc (<i>Fraxinus pennsylvanica</i> / <i>Symphoricarpos occidentalis</i>)				O	O	
	Frpe/Pavi (<i>Padus virginiana</i>)	O					
Chokecherry	Pavi-Syoc/Elsm (<i>Padus virginiana</i> - <i>Symphoricarpos occidentalis</i> / <i>Elytrigia smithii</i>)					O	
GREASEWOOD SERIES							
Greasewood	Save2/Spai (<i>Sarcobatus vermiculatus</i> / <i>Sporobolus airoides</i>)	O					O O
	Save2-Atrr/Elsm (<i>Artemisia tridentata</i> / <i>Elytrigia smithii</i>)	O	O				
	Save2-Atga/Pose (<i>Atriplex gardneri</i> / <i>Poa secunda</i>)	O					

O – indicates the known occurrence of a plant association or community type on a National Forest or Grassland.

* Abbreviation for the name of an established RNA which contains or probably contains this plant association. See listing of established RNAs below.

Solid shading in a Series cell indicates that a Series/Subregion RNA target may have been filled.

Further information about established RNAs may be necessary before this can be determined.

** Shading indicates the occurrence of a targeted Series on a National Forest or Grassland. See "Introduction to the RNA Matrix" for an explanation of RNA targeting.

*** The National Forests of Region 2 have been divided into 3 subdivisions and the Grasslands as a separate subdivision for the purpose of RNA targeting.

See "Introduction to the RNA Matrix" for an explanation of how these divisions correspond to the Provinces and Sections of the Ecological Land Unit Map of Region 2.

**** The plant associations known for the San Isabel NF are listed for both north and south subdivisions until further information becomes available.

XXX Series which probably occur on National Forests or Grasslands but are not substantiated by plant association data.

Plant associations and community types are taken from Johnston, B. 1987. Plant Associations of Region Two. Edition 4. Rocky Mountain Region. R2-ECOL-87-2.

As this matrix appendix indicates, our current knowledge of plant associations and community types on a number of National Forests and Grasslands is incomplete.

An aquatic ecosystem classification will be added to this matrix in the future.

ESTABLISHED RESEARCH NATURAL AREAS IN THE ROCKY MOUNTAIN REGION

Bull Elk Park	Bighorn NF	Acres – 719
Campo	Commanche NG	Acres – 35
Escalante Creek	GMUG NFs	Acres – 44
Gothic	GMUG NFs	Acres – 1050
Hurricane Canyon	Pike and San Isabel NFs	Acres – 520
Mount Goliath	Arapaho and Roosevelt NFs	Acres – 161
Narraquinnep	San Juan NF	Acres – 1928
Saddle Mountain	Pike and San Isabel NFs	Acres – 479
Shell Canyon	Bighorn NF	Acres – 729
Signal Hill	Nebraska NF	Acres – 699
Snowy Range	Medicine Bow NF	Acres – 771
Upper Pine Creek	Black Hills NF	Acres – 1191
Williams Creek	San Juan NF	Acres – 544

At present there is very little known about the plant associations and community types on a number of these RNAs, some of which were established in the 1930s.

CRITERIA FOR RESEARCH NATURAL AREA SELECTION

The Rocky Mountain Region of the U.S. Forest Service is expanding its system of Research Natural Areas (RNAs) as part of a national program. One of the primary purposes of the RNA program is the protection and study of representative examples of the natural variability that occurs on National Forest System lands. RNAs serve as reference areas for evaluating the impacts of management in similar environments, as areas for research, and as areas for protecting important elements of biodiversity, including Threatened, Endangered, and Sensitive (TES) species.

To assist Forests in the selection of potential RNA sites, we developed criteria for RNAs that elaborate the Forest Service Manual (4063). The RNA Matrix for the Region (included as a separate document) identifies ecosystem types that are targeted for inclusion in the RNA System. The RNA criteria are intended as a tool for evaluating sites which represent these ecosystem types.

CRITERIA

1. Quality (how well a site represents the targeted ecosystem type or protected biodiversity elements)
2. Condition (how much the site has been degraded or altered from natural or optimal conditions)
3. Viability (the likelihood of long-term survival for the ecosystem and its protected biodiversity)
4. Defensibility (extent to which the ecosystem and biodiversity elements can be protected from extrinsic human factors)

Some ecosystem types are rare and threatened, and high quality examples should have high priority for RNA establishment. However, also of high priority is the selection of representative sites, which may not necessarily include TES species and may not be unique except as undisturbed sites. Some of the rare ecosystem types are identified in the Biological Diversity Assessment amendment to the Rocky Mountain Regional Guide, May 1992. The RNA Matrix and Appendix will help identify others. Forest Service partnerships with other agencies and entities, including state Natural Heritage Programs have been effective in identifying and prioritizing sites that contain TES species and representative examples of ecosystem types. A separate document will soon be available explaining Natural Heritage Program methodology.

QUALITY

The quality of a site is based on how well it represents the targeted ecosystem type, or the population size, productivity, and vigor of the species being protected. Ecosystem types listed as targets in the RNA Matrix have been defined by Plant Series (named for the dominant overstory plant species - e.g. ponderosa pine), because plant communities in general reflect their biota and the physical environments in which they occur. The "Introduction to the RNA Matrix" should be referred to for further explanation of these ecosystem types and targets.

Representativeness: An RNA or several RNAs should be chosen to represent as much of the range of natural variability as possible for each ecosystem type (Plant Series). For a Series there can be substantial variation in plant associations, species, soils, geology, landform (including elevation, slope, and aspect), climatic regime, successional stages, and ecological processes. The Appendix to the RNA Matrix can be used to determine which plant associations are known to occur within an individual ecosystem type. A highly representative site will capture a large proportion of the known biotic and environmental variability for the ecosystem type being represented.

It is especially important that representative examples of the Forest Service's most productive lands are incorporated in the RNA system. These productive lands are often heavily managed and require undisturbed baselines for evaluating and monitoring the impacts of management.

Because we know so little about the range of natural variability of many of the ecosystems within the Rocky Mountain Region, assessment of representativeness will usually be a qualitative process. In the future the development of Integrated Resource Inventory, GIS systems, and specific research on the range of natural variability and representativeness will greatly aid this assessment. It may take more than one RNA to represent the variability within a Plant Series in a geographical region. Additionally, in order to insure the long-term survival of RNA examples of ecosystem types, a certain amount of duplication in the RNA system is desirable.

Ecological Processes: Many of the Rocky Mountain Region's ecosystems are affected by natural disturbances such as fire, insect and disease epidemics, and windthrow. These disturbances have created a landscape which is often a mosaic of successional patches of different sizes, ages, and distributions. It is desirable to represent the range of successional stages and, where appropriate, the landscape mosaics in which they occur within RNAs.

RNA Size: The FS Manual (4063.1) states: "Research Natural Areas must be large enough to provide essentially unmodified conditions within their interiors. In the West, 300 acres of land is generally considered the minimum size." However, in order to represent a variety of successional stages, landscape patterns, plant associations, and environmental variables, RNAs for some ecosystem types will often need to be considerably larger than 300 acres. Some proposed RNAs in the Rocky Mountain Region currently exceed 5000 acres.

The viability of species and persistence of natural disturbance patterns are also often size dependent.

TES Species: As stated in the FS Manual (4063), Research Natural Areas can be designated to protect Threatened, Endangered, and Sensitive (TES) species as well as to represent a range of ecosystem types. The quality and desirable size of an RNA site for TES species is usually determined by assessing population size and distribution, and the maturity, vigor, productivity, and reproduction of individuals in the population. The value of a site for RNA designation is usually significantly increased by the presence of both excellent examples of ecosystem types and TES species.

CONDITION

Condition is a measure of how much the site has been degraded from natural conditions. Natural will be used to mean presettlement or our estimate of the condition that an ecosystem would be in if settlement by peoples from Europe, Asia, and Africa had not occurred. The ancient Native American practice of burning vegetation has had a significant impact on some ecosystems and will be considered part of the natural condition.

It is desirable to find sites for RNA designation without alien (non-native) species, roads, trails, buildings, fences, irrigation ditches, dams, mining activity, past logging, grazing, recreational use, the effects of fire suppression, etc. However, the best representatives of targeted ecosystem types or populations of TES species in the Rocky Mountain Region may have some degree of non-native species or past or present human disturbance. These disturbances need to be evaluated for their impact on ecosystem composition, structure, and function and the potential for the habitat to recover from disturbances.

The FS Manual (4063.2) states: "In the selection of representative areas, a pristine condition is the goal. However, when candidate areas in a pristine condition are unavailable, then areas that reflect the pristine condition as closely as possible may be selected."

Alien and Native Species: The presence of native plant species and the relative absence of alien (non-native) species are often good indicators of the condition of a site because much of the landscape in the western United States has been seriously invaded by alien species. We must determine whether significant areas of a site have had their composition and structure significantly altered by alien species. The FS Manual (4063.2) states: "In certain geographic regions and in certain community types, it will be impossible to find candidate areas not containing alien plant or animal life. Under these circumstances, the best available area that qualifies in all other respects should be chosen."

Most Rocky Mountain ecosystems are also lacking members of the native fauna. Wolves, grizzly bears, wolverines, and lynx are absent from most of the Region's Forests; and buffalo, wolves, and elk are absent from most of the Grasslands. Although this is a departure from natural conditions, it is a

situation, unless these species are reintroduced, that the RNA system will usually have to live with.

Logging: The FS Manual (4063.2) states: "Whenever possible, select proposed areas that show no evidence of major disturbances by humans, such as livestock grazing or timber cutting, for the past 50 years." This statement is qualified in important ways. "Whenever possible" and "major" are added in recognition that the best remaining examples of certain ecosystem types in some regions may have experienced past timber cutting or livestock grazing. A few recent stumps from individual tree removal may have negligible impact on the site as a whole. However, the question arises: How many cut trees (over how much area and how long ago) will compromise the natural condition or viability of a site and do these cut trees mean that a native tree species is now absent? The answer to this question will often require site specific professional judgement.

Livestock Grazing: Livestock grazing can alter the natural condition of ecosystems by increasing less palatable (and alien) species and decreasing (or eliminating) more palatable species. In the extreme, overgrazing can produce unnatural amounts of bare ground and erosion. As with past logging, the impact of past grazing on natural conditions needs to be evaluated on a site specific basis. Some ecosystem types in the Rocky Mountain Region, especially Great Plains grasslands, evolved under extensive grazing by native herbivores. In these cases a carefully evaluated amount of cattle, sheep, or horse grazing might be used to simulate the effects of absent buffalo, elk, moose, deer, pronghorn, bighorn sheep, or mountain goat grazing. The native vegetation may depend upon grazing. Although often impractical, ideally native herbivores could be reintroduced into areas from which they have been extirpated.

Structures, Roads, Trails, and Recreation: In general structures are not allowed on Research Natural Areas. However, the presence of historic structures protected by law may not be considered an impediment to RNA designation. The FS Manual (4063.3) states: "Do not permit roads, trails, fences, or signs on an established RNA unless they contribute to the objectives or to the protection of the area." However, because of the prevalence of trails throughout the Rocky Mountain Region, it would be difficult to establish most of the best RNA candidates without trails or some degree of recreational use. Many recreational trails contribute to RNA objectives by providing necessary access for scientific research and monitoring. However, increased use for recreation is often a problem and should be discouraged.

A few established RNAs contain dirt roads. If a site containing a dirt road is the best representative of a targeted ecosystem type, questions such as the following need to be addressed: Is the road a significant conduit for the introduction of alien species to the site? Is the road likely to interfere with the movement of native species or the functioning of natural processes such as fire?

Existing trails and recreational use need to be evaluated for their impacts to ecosystem composition, structure, and function and TES species. The FS Manual (4063.3) directs the Forest Supervisor to limit, restrict, or control

activities that are not compatible with the objectives of the RNA. Management can go a long way toward alleviating potential RNA/recreation conflicts. After an RNA is established or proposed in a Forest Plan, the building of structures, roads, trails, and dams will be prohibited. However, the realignment of a trail to protect resources may be necessary in certain cases.

VIABILITY

Viability refers to the likelihood of long-term survival of the ecosystem or species. Size, connectivity, position in the landscape, and surrounding land use are often the important factors in evaluating viability. Research in conservation biology indicates that small natural areas may be inadequate for the long-term protection of natural conditions. The influence of exterior environments (e.g. logging bordering RNAs) can extend well into the interior of natural areas; minimum viable populations of many vertebrate species require large areas; alien species can overwhelm small natural areas; and many ecological processes operate at large spatial scales.

Connectivity and Watersheds: RNAs which are connected to other relatively natural portions of the landscape such as Wilderness have increased chances of viability. Connectivity in the landscape increases gene flow, animal and seed dispersal, and the maintenance of minimum viable populations of many animal species. Watershed boundaries help insure the integrity of the hydrological regime and protect RNAs from upstream human disturbance. The FS Manual (4063.2) states: "Where possible, select entire small drainages because they maintain interrelationships of terrestrial and aquatic system, particularly valuable as baseline areas for research and monitoring, and because they are easier to delineate and protect on the ground."

Ecological Processes: The viability of ecosystems depends to a large degree on the functioning of ecological processes such as disturbance, succession, nutrient cycling, pollination, and predation. To illustrate: Many riparian ecosystems depend upon a disturbance regime of recurring floods. These floods deposit sediment loads, provide essential seed beds for the establishment of trees such as narrowleaf cottonwood, and rearrange channel banks and point bars. Dams interrupt this natural process of flooding and over time will shift riparian ecosystems outside the range of natural variability. Similarly, limber pine forests may depend upon seed dispersal by Clark's nutcrackers; lodgepole pine forests often require periodic fires for their regeneration; and many grasslands are rejuvenated by both grazing and fire.

Natural Disturbances: We can usually evaluate only a few of the more important processes which control ecosystems. Fire, insect and disease epidemics, and windthrow are among the dominant disturbance processes that have helped mold many of the ecosystem types in the Rocky Mountain Region. As fires, windstorms, and insect epidemics move across the landscape they often leave behind a mosaic or patchwork of affected and unaffected environments. For many ecosystem types these natural disturbance regimes influence the desirable RNA size.

Large size not only provides greater representation of the variability in successional stages produced by natural disturbance, it also protects natural areas from single cataclysmic events. In the case of fire, successional patches often serve as firebreaks that reduce the extent of large-scale fires in drought years. If an RNA is the size of a single successional patch, it could potentially succumb to a moderate size fire and not have a nearby source of native seed to repopulate it. RNA redundancy for fire dependent ecosystem types is particularly important.

For some forest types it will be difficult to find stands that have not been impacted by decades of fire suppression. In our search for sites in a natural condition, we will often have to accept some degree of past fire suppression. The impacts of this suppression may be difficult to judge without knowing the presettlement fire frequency and the amount of historic fire suppression on the site in question. We have to do the best we can. It may be necessary to try to restore a natural fire regime to some RNA sites through prescribed burning, but this should be done with great care and only after thorough scientific analysis.

DEFENSIBILITY

The defensibility of a site is the extent to which the ecosystem and its species can be protected from extrinsic human factors that might otherwise degrade or destroy it.

Surrounding land use and the topographic position of a site will influence the defensibility and viability of an RNA. Environmental concerns, including ground-water pumping, upstream dam construction and water diversion, pesticide drift, large scale air pollution, and even vandalism can have serious effects on natural areas. For some sites large size and watershed boundaries will help mitigate the potential negative impacts of some surrounding land uses. Sites for RNAs need to be evaluated in a landscape context that may require coordination with other land management agencies and landowners. The desirable size and boundaries for an RNA will depend on the targeted ecosystem type, the frequency and extent of natural disturbance regimes, the location in the landscape, and surrounding land use.

review draft

review draft

**THE ROLE OF RESEARCH NATURAL AREAS
IN ECOSYSTEM MANAGEMENT
ON NATIONAL FOREST SYSTEM LANDS**

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Rocky Mountain Region and Rocky Mountain Experiment Station
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GOAL: The Rocky Mountain Region and Experiment Station recognize the need to create a comprehensive and representative system of Research Natural Areas (RNAs) which will be useful for research and ecosystem management on National Forest System lands.^{40,41,42} This document is intended to help clarify the meaning and utility of the RNA system for the Region and Experiment Station.

RESEARCH NATURAL AREAS: The Forest Service Manual (4063.02) states that one of the objectives of RNAs is to "preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geological, and similar natural situations that have special or unique characteristics of scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity."

ECOSYSTEMS: Because the word "ecosystem" has acquired so many meanings, a working definition will probably be useful. An ecosystem can be defined as all of the biological and physical (including chemical and geological) components within a defined space and the processes which affect these components.²⁴ Ecosystems are usually studied as flows of energy, material, and species through space and time. Ecosystems include everything from a drop of pond water to the biosphere. Ecosystems are dynamic. They have changing and flexible boundaries depending on the scale of the components and processes under consideration. Clearly, humans are components of ecosystems and their activities affect ecosystem composition, structure, and function.^{1,14} Some ecosystems have evolved with human influence for thousands of years.²² The existence of human civilization and life on Earth are totally dependent upon the functioning of ecosystems.

ECOSYSTEM MANAGEMENT is an evolving approach to resource management within the U.S. Forest Service. One definition of ecosystem management is the management of biological, physical, and human components and processes of ecosystems in ways that maintain sustainable ecological processes, biodiversity, environmental quality, and the production of resource commodities and amenities.^{1,9,15,26,28,30,39} Ecosystem management integrates ecosystem components, processes, and resource uses.^{26,28,31} Ecosystem and social sustainability are the cornerstones of a holistic approach to ecosystem management.^{15,29,34,43}

Biodiversity and biological processes occur at genetic, species, population, community, ecosystem, landscape, and regional scales^{5,23} and need to be managed over a variety of spatial and temporal scales.^{12,15} Ecosystem sustainability requires the maintenance of the diversity of plant and animal species and natural processes such as succession, disturbance, and evolution.³⁹ Combining this requirement with the necessity of producing wood, forage, and recreational opportunities is often a challenge and occasionally a conundrum.^{12,29,32}

Some areas of National Forest System lands have departed significantly from their natural condition.^{12,21} "Natural" like the word "ecosystem" has many potential meanings. For our purposes natural condition will mean presettlement or our estimate of the condition that an ecosystem would be in if settlement by peoples from Europe, Asia, and Africa had not occurred - ecosystems with relatively intact evolutionary relationships.^{14,19} Some lands have been through many timber rotations, or planted with monocultures of genetically similar trees, or grazed by domestic livestock for decades. Some lands have been invaded by non-native weed species, while others are heavily impacted by recreation. Many of these departures from a natural condition occurred on lands before they became a part of the National Forest System. As human demands increase, fewer examples of natural ecosystems remain and some managed lands retreat further from their natural condition.^{12,20,21,25}

To reduce the risk associated with our limited knowledge and to insure ecosystem health, diversity, and sustainability, it is prudent to manage some ecosystems within their range of natural variability.^{1,2,12,19,26} It would be difficult to determine the range of natural variability without reference to areas such as RNAs that are relatively undisturbed by humans.^{19,20,25}

RNAS AS BENCHMARKS: Many management activities on National Forest System lands can be thought of as experiments.²⁸ The outcome of these experiments in boardfeet, AUMs, or public satisfaction is often calculable. However, many important phenomena, including changes in vegetation, animal populations, soil quantity and quality, plant susceptibility to insect and disease epidemics, and changes in future productivity, are often incompletely understood.¹²

If Forest Service management is an "experiment", then reference points are necessary to evaluate the success of the experiment. This function of being a reference or benchmark is one of the principal values of Research Natural Areas, which are among the least modified sites on Forest Service lands.^{8,10,12,18,20,25,37,38} Whether we want to monitor site productivity, soil loss, populations of small mammals, neotropical bird migrants, indicator species, the health of endangered species populations, nutrient cycling, amounts of coarse woody debris, or the impacts of road density on elk populations, reference points are necessary. In Forest Service monitoring, standards to which managed lands can be compared will often be essential.

As an example, on a Forest Service allotment in the Southwest it was argued that obvious gullying and erosion were more the result of weather and fragile

soils than of cattle grazing. A designated natural area with similar fragile soils, climate and vegetation, but no recent livestock grazing, provided a reference, showing that the grazed lands had erosional rates and vegetation loss far outside the range of natural variability (Moir, W. pers.comm.). Livestock grazing regimes have economic, cultural, and political as well as biological ramifications. Yet, without a firm grasp of ecological reality, which RNAs can often provide, the environmental analysis required by NEPA may rest on a poor foundation, ecosystem sustainability may diminish, and the future needs of society may not be met.

THE RNA SYSTEM: Wilderness, Special Interest Areas, RNAs, and other natural areas can all help provide the references necessary for management and environmental analysis.¹⁰ Among these, the Research Natural Area system is unique because of its goal of providing high quality, relatively pristine, representative examples of the full range of ecosystem types that occur on National Forest System lands. To be useful for management comparison, the RNA system should include good examples of the most productive lands in the National Forest System.^{12,20}

Ideally the RNA system should represent a substantial portion of the variability in National Forest ecosystems, including variability in biota, landforms, geology, soils, climate, successional stages, disturbance regimes, and other ecological processes. Since the variation in plant communities often reflects other forms of biotic and abiotic variation,^{7,27} plant communities have been chosen initially for defining the RNA system. These communities have been identified at the plant association, plant series, or higher plant community levels by most Regions.^{8,16,18} Advances in Forest Service hierarchical ecological maps, Integrated Resource Inventories, and GIS systems^{9,26} will help refine the RNA system, measure its representativeness, and make it more valuable as a comparative tool in ecosystem management.

Research Natural Areas need to be large enough to encompass a mosaic of successional stages and disturbance patterns as well as a wide range of biotic and abiotic variability. Large size will help maintain natural processes and viable animal and plant populations and minimize deleterious edge effects. Research in conservation biology has shown that the integrity and value of natural areas increases significantly with size.^{3,4,6,21,23,33,35}

RNAS AS RESEARCH SITES: Closely related to the important function of RNAs as reference areas is their availability as sites for scientific research. Ecosystem management implies an understanding of how ecosystems operate.^{26,28,31} Unfortunately, our understanding of ecosystems and how humans affect and are affected by ecological processes is fairly rudimentary. RNAs can provide a tool for understanding the functioning of ecosystems in landscapes and the sustainability of both ecosystem processes and community components.

Plant and animal species have evolved adaptations to each other and to their environment which are expressed in complex patterns of succession, predation, herbivory, parasitism, pollination, dispersal, and survival. These biological

patterns, in turn, are influenced by patterns of natural disturbance, geomorphic processes, and climate change.^{5,12,24} Because species and their complex relationships have evolved and continue to evolve in natural ecosystems, they are best studied in areas which have undergone minimal human disturbance.^{2,4,14,19,20,35,38} We also know that some of our "natural" ecosystems have been influenced by thousands of years of human disturbance, such as the burning of grasslands by Native Americans.^{14,19} This knowledge will influence our management of some RNAs and other National Forest System lands.

The Research Natural Area system is intended to include the full array of terrestrial and aquatic ecosystems for the scientific research necessary to ecosystem management.^{37,38} RNAs provide an opportunity for studying the same ecological process over a range of ecosystem types. Baseline data and long-term ecological research on RNAs will provide an important body of information for land and water management.⁴ These data and research from RNAs will be useful for cumulative effects analysis on similar managed ecosystems and for investigating the impacts of global climate change.¹² RNAs are great natural libraries, "unconditional gifts of potential knowledge for the future."¹⁹

Scientific information from RNAs can change our basic understanding of ecological processes and offer important guidance for ecosystem management. As an example, old-growth forests have been previously characterized as decadent stands with little productivity. Permanent plots dating from the 1930s on an RNA in the Pacific Northwest have documented that some old-growth forests have much higher levels of productivity than previously thought possible (Greene, S. pers.comm.). In the increasingly complicated times ahead, scientific research on minimally disturbed ecosystems will be essential to the task of successfully managing National Forest System lands.

RNAS AS SITES FOR BIODIVERSITY PROTECTION: The protection of biodiversity is an important goal of ecosystem management.^{9,26,28,30} RNAs and other protected natural areas harbor only a small portion of the total biodiversity on National Forest System lands.¹² Nevertheless, a system of RNAs, composed of the best remaining examples of most ecosystem types, is a significant contribution to biodiversity protection in its own right.^{20,36} Because we know so little about the diversity of non-vascular plants, soil micro-flora and fauna, terrestrial and aquatic invertebrates, and many other elements of biodiversity (as well as the complex relationships and processes which connect them), the RNA system helps provide a safety net, a form of insurance against the loss of species and biotic communities. This is a coarse filter approach to protecting biodiversity.³⁶

Additionally, many RNAs offer protection for populations of Threatened, Endangered, and Sensitive species and for rare and sensitive plant communities and animal habitats (the fine filter approach).^{40,41} In California alone, over 132 rare plant species are found on Forest Service RNAs.¹⁶ RNAs can provide benchmarks for evaluating the success of biodiversity protection on National Forest System lands and help meet some of the legal obligations for protection and monitoring required by NFMA, NEPA, and the Endangered Species Act.²⁶

Research Natural Areas are embedded in a matrix of lands with many different management prescriptions. Within the larger managed landscape, some RNAs may function as core areas for the maintenance of genetic diversity and sensitive species, or, in a few circumstances, an individual RNA might serve as a corridor for dispersal and migration of some plant and animal species.^{10,11,21,22,33} RNAs are not isolated units; they are integral parts of a landscape mosaic which needs to be managed as a whole.^{4,10,11} The surrounding landscape will occasionally need to be managed to insure the integrity of RNAs. Coordination and cooperation across ownership boundaries may be desirable to help insure this integrity. RNAs are generally a direct benefit to biodiversity at most of the spatial and temporal scales implicit in ecosystem management.

RNAS IN FOREST PLANNING: RNAs can contribute to the land and resource management planning process by providing models for some of the landscape features the Forest Service would like to extend, restore, and plan for. Information provided by RNAs can help achieve desired future conditions that balance "goals for the land with goals for the people."³⁹ By identifying sites which fill gaps in the RNA system and by developing management plans for RNAs, National Forests and Grasslands can make valuable contributions to ecosystem management. RNAs will also provide useful tools for helping to insure that Forest Service management activities meet the environmental requirements of the law. Ecological research, of the kind performed on RNAs, needs greater recognition for its importance to society and as one of the significant multiple-uses of public lands.

RNAS IN CONSERVATION PARTNERSHIPS: Developing constructive partnerships is a tenet of ecosystem management.^{9,26,28,30} Many individuals and organizations have a great interest in Research Natural Area programs, including state Natural Heritage and Natural Areas programs, The Nature Conservancy, Native Plant Societies, many academic institutions, and the scientific community at large. Conservation partnerships with these diverse parties have been of mutual benefit to both the public and the Forest Service.^{26,42} Statewide conservation planning, in which Forest Service RNA programs play a key role, can forge effective working partnerships between government agencies, private organizations, and the scientific community.^{8,18} RNAs can be effectively used as interpretive and educational tools to demonstrate the scientific basis for land management and to increase dialogue with the public. Within the Forest Service, Research Natural Areas provide an important bridge between the concerns of Research and National Forest Systems.

CONCLUSION: In the future, Research Natural Areas will be one of the more useful tools available to the Forest Service for improving and evaluating the success of ecosystem management. Because of the multiple purposes they serve and the important biodiversity and ecosystem processes they harbor, RNAs have high value for present and future generations.

LITERATURE CITED

1. Agee, J.K. and D.R. Johnson (eds.). 1988. Ecosystem management for parks and wilderness. University of Washington Press, Seattle.
2. Anderson, J.E. 1991. A conceptual framework for evaluating and quantifying naturalness. Conservation Biology 5:347-352.
3. Baker, W.L. 1992. The landscape ecology of large disturbances in the design and management of nature reserves. Landscape Ecology 7:181-194.
4. Bildstein, K.L. and I.L. Brisbin. 1990. Lands for long-term research in conservation biology. Conservation Biology 4:301-308.
5. Brussard, P.F. 1991. The role of ecology in biological conservation. Ecological Applications 1:6-12.
6. Crow, T. 1991. Landscape ecology: The big picture approach to resource management. Pages 55-65 in Decker, D.J. et al. (eds.) Challenges in the conservation of biological resources. Westview Press, Boulder, CO.
7. Daubenmire, R.F. 1976. The use of vegetation in assessing the productivity of forest lands. Botanical Review 42:115-143.
8. Department of Natural Resources, Washington State. 1987. State of Washington Natural Heritage Plan. Olympia, Washington.
9. Estill, E. and H. Montrey. 1992. The Rocky Mountain Region and Rocky Mountain Station Joint Strategy for Implementing Ecosystem Management. USDA Forest Service, Denver, CO: September 4, 1992.
10. Evenden, A, P. Landres, and A. Watson. 1993. The role of wilderness/natural areas in ecosystem management. USDA Forest Service. Northern Region and Intermountain Research Station.
11. Forman, R.T.T. and M. Godron. 1986. Landscape ecology. John Wiley & Sons, NY.
12. Franklin, J.F. 1992. Scientific basis for new perspectives in forests and streams. Pages 25-72 in Naiman, R.J. (ed.) Watershed Management: Balancing Sustainability and Environmental Change. Springer-Verlag, NY.
13. Hunter, M.L. 1991. Coping with ignorance: the coarse-filter strategy for maintaining biodiversity. In: Korn, K.A., ed. Balancing on the brink of extinction - the endangered species act and lessons for the future. Island Press, Washington, D.C.
14. Hoerr, W. 1993. The concept of naturalness in environmental discourse. Natural Areas Journal 13:29-32.
15. Jensen, M.E. and P.S. Bourgeron, eds. 1993. Ecosystem management: Principles and applications. USDA-Forest Service, Northern Region, Missoula, MT.
16. Keeler-Wolf, T. 1990. Ecological Surveys of Forest Service Research Natural Areas in California. USDA Forest Service. GTR PSW-125.
17. Leopold, A.S. 1949. A Sand County Almanac. Oxford University Press, NY.
18. Loop, D.J. 1986. Montana natural areas conference proceedings. The Nature Conservancy, Helena, Montana.
19. Maser, C. 1990. On the naturalness of natural areas: a perspective for the future. Natural Areas Journal 10:129-133.
20. Moir, W.H. 1972. Natural areas. Science 177:396-400.
21. Noss, R. 1987. Protecting natural areas in fragmented landscapes. Natural Areas Journal 7:2-13.

22. Noss, R. 1987. Corridors in real landscapes: A reply to Simberloff and Cox. Conservation Biology 1:159-164.
23. Noss, R. 1983. A regional landscape approach to maintain diversity. Bioscience 33:700-706.
24. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co., Philadelphia.
25. Odum, E.P. and H.T. Odum. 1972. Natural areas as necessary components of man's total environment. Transactions of the North American wildlife and natural resources conference 37:178-189.
26. Overbay, J.C. 1992. Ecosystem management. Delivered at the National Workshop on "Taking an Ecological Approach to Management," Salt Lake City, UT. USDA Forest Service: April 27, 1992.
27. Pfister, R.D. and S.F. Arno. 1980. Classifying forest habitat types based on potential climax vegetation. Forest Science 26:52-70.
28. Robertson, F.D. 1992. Ecosystem management of the national forests and grasslands. Memo to Regional Foresters and Station Directors. USDA Forest Service, Washington, D.C.: June 4, 1992.
29. Rowe, J.S. 1992. The ecosystem approach to forestland management. The Forestry Chronicle Vol 68, No.2, April.
30. Salwasser, H. 1992. Ecosystem management. Charter for Washington Office Staff and Interdisciplinary Teams. USDA Forest Service, Washington, D.C.: July 28, 1992.
31. Salwasser, H. 1992. From new perspectives to ecosystem management: response to Frissel et al. and Lawrence and Murphy. Conservation Biology 6:469-472.
32. Salwasser, H. 1991. New perspectives for sustaining diversity in U.S. national forest ecosystems. Conservation Biology 5:567-569.
33. Saunders, D.A. et al. 1991. Biological consequences of ecosystem fragmentation: A review. Conservation Biology 5:18-32.
34. Sexton, W.T. and R.M. Znerold. 1993. A philosophy and strategy for ecosystem management on the San Juan National Forest. USDA Forest Service.
35. Soule, M.E. and D. Simberloff. 1986. What do genetics and ecology tell us about the design of nature reserves? Biological Conservation 35:19-40.
36. The Nature Conservancy. 1982. Natural Heritage Program Operations Manual. The Nature Conservancy, Arlington, VA.
37. Tippetts, D. 1990. Preserving Research Natural Areas. Forestry Research West. Dec. p. 10-16.
38. USDA Forest Service. 1992. Preparing for the future: Forest Service Research Natural Areas. USDA Forest Service FS-503.
39. USDA Forest Service. 1992. Ecosystem management principles. Summary recommendations from "Taking an Ecological Approach to Management" Workshop, Salt Lake City, Utah, April 27-30, 1992, USDA Forest Service.
40. USDA Forest Service. 1992. Rocky Mountain Regional Guide. Denver, Colorado.
41. USDA Forest Service. 1992. Biological diversity assessment: A technical report used in amending the Rocky Mountain Regional Guide. Denver, CO.
42. USDA Forest Service. 1992. R2 Supplement No. 4000-92-1 to the Forest Service Manual (FSM 4063). Denver, Colorado.
43. Znerold, R.M. and other members of the Ecosystem Taskforce. 1992. An ecological approach to management. A framework for national guidance. USDA Forest Service.

6.3 RESEARCH NATURAL AREA

Emphasis: Research Natural Areas (RNAs) form a network of ecological reserves designated for non-manipulative research, education, and the maintenance of biodiversity. This prescription is applicable to designated RNAs and areas which are proposed for RNA designation.

Desired Future Condition: RNAs are selected to preserve a spectrum of relatively pristine areas that represent a wide range of natural variability within important natural ecosystems and environments (e.g. forest, shrubland, grassland, alpine, aquatic, and geological environments) and areas that have special or unique characteristics of scientific importance. RNAs are also selected to: serve as reference areas for evaluating the range of natural variability and the impacts of management in similar environments; protect and maintain representative and key elements of biological diversity at the genetic, species, population, community, and/or ecosystem levels; serve as areas for the study of ecosystems and ecological processes including succession; provide onsite and extension educational activities; and serve as baseline areas for measuring ecological change.

RNAs are managed to maintain natural (relatively pristine/presettlement) conditions by allowing ecological processes to prevail with minimal human intervention. However, under some circumstances, deliberate manipulation may be utilized to maintain the ecosystem or unique features for which the RNA was established or to reestablish natural ecological processes. Vegetation, habitat, soil productivity, water quality, and ecological processes will be in natural condition (within the range of natural variability). Specific management direction (addressing fire, grazing, etc.) will be developed for each RNA as part of the Establishment Record or in separate Management Implementation Guidelines.

The setting is natural. The sights and sounds of people as well as other management activities within the area will be infrequent, but may be common in adjacent areas.

No new facilities will be provided. Motorized use is prohibited, except when necessary to provide research or educational access.

Recreational use is allowed, but not encouraged, except for interpretation and education. Publicity that would attract the general public to the area will be avoided.

No extractive uses are allowed, except those arising from existing mineral rights.

MANAGEMENT AREA STANDARDS AND GUIDELINES

(These apply in addition to Forestwide Standards and Guidelines.)

General

- 1 Protect the natural condition of the ecosystem and its processes and any species or values for which the RNA was proposed. **Standard**

Recreation Management

- 2 Allow nonvehicular recreation, except when it is a threat to the values for which the RNA was proposed. **Standard**
- 3 Allow trails which exist prior to RNA proposal for recreation and scientific or educational access, except when they are a threat to the values for which the RNA was proposed. **Guideline**
- 4 Utilize restrictions or closures under 36 CFR subpart B when necessary to protect the area from actual or potential damage due to public use. **Standard**

Travel Management

- 5 Prohibit the construction of new roads and trails, except when new trails are necessary to correct resource damage occurring from existing trails. **Standard**
- 6 Prohibit mountain bikes and all other vehicular use, except when they provide necessary access for scientific or educational purposes. **Standard**
- 7 Close or obliterate existing roads, except where they provide necessary access for scientific or educational purposes. **Guideline**

Vegetation Management

- 8 Prohibit logging and wood gathering activities. **Standard**

Range Management

- 9 Prohibit livestock grazing, except when it is used to approximate a natural grazing regime for maintaining the native vegetation. **Guideline**

Fish and Wildlife Management

- 10 Allow (but do not encourage) hunting and fishing, except when they are a threat to the values for the which the RNA was proposed. **Guideline**
- 11 Prohibit habitat manipulation for wildlife, unless it is part of Management Implementation Guidelines to provide for more natural conditions. **Guideline**

- 12 Allow habitat manipulation when it is necessary for the protection of Threatened, Endangered, and Sensitive Species. **Standard**

Fire and Fuels Management

- 13 Allow prescribed natural fires to burn. **Guideline**
- 14 Control human caused fires that are a substantial threat to human development outside RNA boundaries, and all fires where excessive fuel buildup from past fire suppression threatens the RNA. **Guideline**
- 15 Use fire suppression techniques which minimize disturbance. Use natural barriers to confine or contain fire where possible. **Standard**
- 16 Use management ignited prescribed fire when it is necessary to restore a natural fire regime or to reduce unnatural fuel loads. **Guideline**

Integrated Pest Management

- 17 Allow natural outbreaks of native insects and diseases to proceed without intervention, unless they are a substantial threat to important resources inside or outside of RNA boundaries. **Standard**
- 18 Use control methods which minimize disturbance. **Standard**
- 19 Control populations of exotic (non-native) plant and animal species, where feasible. Use control methods which minimize threats to native species. **Guideline**

Facilities Management

- 20 Prohibit buildings and developed recreation sites, unless there are exceptional circumstances (such as historic sites listed in the National Registry) which do not threaten the values for which the RNA was proposed. **Standard**

Minerals Management

- 21 Withdraw the area from mineral entry in conformance with Section 204 of Federal Land Policy and Management Act of 1976 (PL 94-576) when withdrawal is necessary to protect the values for which the RNA was proposed. **Standard**

Special Uses

- 22 Permit special uses only if they do not conflict with the values for which the RNA was proposed. **Standard**
- 23 Require approval of proposals for non-manipulative research by the RM Station Director (or representative) and the District Ranger. **Standard**

6.5 SPECIAL INTEREST AREAS

Emphasis: Management emphasis is on protecting or enhancing (and where appropriate, developing and interpreting for public education and recreation) areas of unusual characteristics.

Desired Future Condition: These areas are managed to maintain their special interest values. Typically, Special Interest Areas (SIAs) have been designated as botanical, geological, historical, paleontological, scenic, and zoological areas. SIAs can be designated to protect and manage Threatened, Endangered, and Sensitive Species and other elements of biological diversity, or for their emotional significance, scenic values, or public popularity. SIAs can vary from small to fairly large areas. In addition, places such as caves, hot springs, cultural resource sites, 14,000 foot peaks, significant views, state-designated historic sites, and potential developed sites could be considered for SIAs.

Vegetation, terrestrial and aquatic habitat, soil productivity, and water quality will usually, but not always, appear near natural (relatively pristine/presettlement). Vegetation manipulation may be used to maintain or restore natural conditions or protect Threatened, Endangered, and Sensitive species or other values for which the SIA was proposed. Management Implementation Guidelines will be developed for each SIA in order to insure protection of the values for which the SIA was designated.

The setting is usually natural, but will vary depending on the area.

Facilities will be present to the extent needed to maintain the area or to facilitate visitor use of the area.

Recreational use of the area is primarily intended for interpretation, educational, and inspirational activities.

No extractive uses are allowed, except those arising from existing mineral rights or where they are necessary for maintaining the values for which the SIA was designated.

MANAGEMENT AREA STANDARDS AND GUIDELINES

(These apply in addition to Forestwide Standards and Guidelines.)

General

- 1 Protect and manage the biodiversity, geological, historical, paleontological, or other values for which the SIA was designated.
Standard

Recreation Management

- 2 Allow recreation use, with emphasis on interpretation, education, and inspiration, when it does not threaten the values for which the SIA was designated. **Standard**
- 3 Utilize restrictions or closures under 36 CFR subpart B when necessary to protect the area from actual or potential damage due to public use. **Standard**

Travel Management

- 4 Construct new roads or trails only when they are necessary for interpretive or educational purposes or will correct resource damage occurring from existing roads or trails. **Standard**

Vegetation Management

- 5 Allow vegetation manipulation (such as stand thinning and wood gathering) when it is necessary to reduce excessive fuel loads, maintain or restore natural conditions, or enhance other values for which the SIA was designated. **Standard**
- 6 Remove SIAs from the suitable timber base. **Standard**

Range Management

- 7 Allow livestock grazing if it does not conflict with the values for which the SIA was designated. **Guideline**

Fire and Fuels Management

- 8 Manage fire and fuels (through suppression practices, management ignited prescribed fire, and vegetation manipulation) to protect the values for which the SIA was designated or to maintain or restore natural conditions. **Standard**

Minerals Management

- 9 Withdraw this area from mineral entry in conformance with Section 204 of Federal Land Policy and Management Act of 1976 (PL 94-579) when withdrawal is necessary to protect the values for which the SIA was designated. **Standard**

Special Uses

- 10 Allow authorization of scientific activity or other activities that are compatible with the SIA's values through special use permits with terms that protect or enhance the area. **Standard**